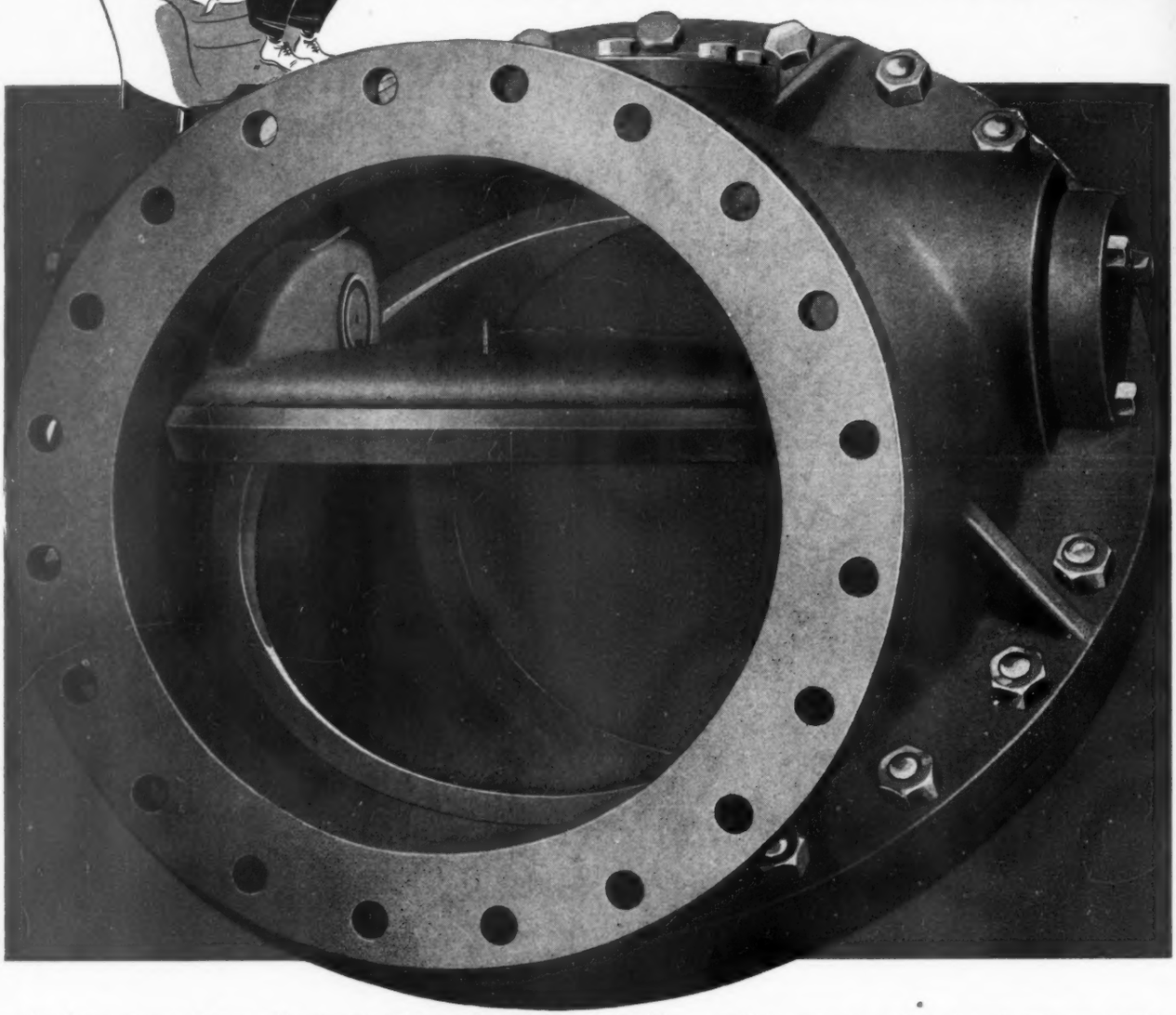
WATER WORKS & SEWERAGE

"A HORRIBLE EXAMPLE"
WHAT AN UNSUSPECTED WATER DID TO STEEL PLATES
(See first article this issue.)

NO SOUND... NO JAR... NO DAMAGE

to the CUSHIONED SEATING

of Chapman Non-Slam Check Valves



As flow slows down, Chapman's balanced airfoil disc closes *silently* to a drop-tight seat, without even a flutter. So there's no water-hammer or surging to vibrate the line or open up the flange joints. And head loss is cut 65% to 80%.

What's more, there's no rubbing or wear in the valve itself . . . which means reduced maintenance. This unique Tilting Disc Non-Slam Check Valve is made for pressures from 150 to 1500 lb., with any type of end connection, in iron or steel. Write for illustrated book giving complete operating data and test results.

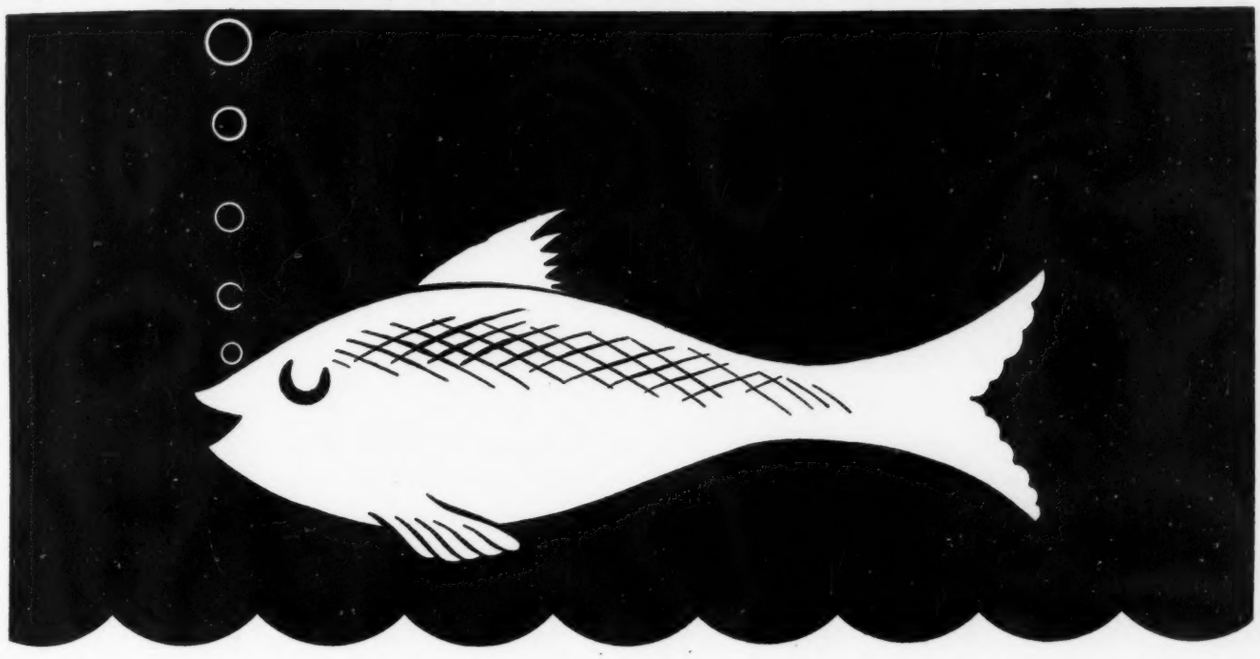
THE CHAPMAN VALVE MFG. CO., INDIAN ORCHARD, MASS.

CHAPMAN

NON-SLAM CUSHIONED CLOSING

CHECK VALVES

FOR REAL SUSPENDABILITY



Use Aqua NUCHAR *Activated Carbon*

Since tastes and odors are removed from water by actual contact of the impurities with the activated carbon surface, greater efficiency can be obtained by longer contact periods. Thus it is obvious that lighter particles, which stay in suspension longer, have more time to carry on their work of purification than a heavier type carbon which settles quickly to the bottom of the basin, with only part of its adsorptive power utilized.

The extraordinary suspendability of AQUA NUCHAR is due largely to its extreme porosity. Scientific measurements show that one cubic foot of AQUA NUCHAR has a surface area (external and internal) of 20,000 square yards. Write for a generous sample of AQUA NUCHAR with which you can prove its superior suspendability.

INSURES PALATABLE — NUCHAR — AQUA — DRINKING WATER

INDUSTRIAL CHEMICAL SALES

DIVISION WEST VIRGINIA PULP & PAPER COMPANY

230 PARK AVENUE, NEW YORK CITY
35 E. WACKER DRIVE, CHICAGO, ILLINOIS
748 PUBLIC LEDGER BLDG., PHILADELPHIA, PA.
844 LEADER BLDG., CLEVELAND, OHIO.

WATER WORKS & SEWERAGE, September, 1942. Volume 89. Number 9. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under Act of March 3, 1879.

Is your scrap "hiding" from our fighting men?

THE SCRAP SITUATION IS SERIOUS.

Waste materials—scrap metals, rubber, and all the rest—are desperately needed for our war effort. For example, it takes roughly a half-ton of scrap steel and a half-ton of pig iron to make a ton of new steel for vital equipment.

How much scrap is needed?

Six million tons *more* than can be obtained from regular sources of scrap this year. War production will suffer, and battles may be lost unless these *extra* tons are collected by December. But it doesn't stop there. The effort must be continued as long as the war lasts.

All scrap collected will be purchased by the steel industry at government-controlled prices.

Are you set up to do your part?

Do you have a salvage committee for every division and department with an energetic man in charge . . . a salvage "clean-up" day every week . . . a plan to scrap all obsolete equipment and unusable parts?

Remember, no quantity of scrap is too small to be salvaged. Every pound turned in will help relieve the continuing shortage.

We're all in this together and the only way out is to *get together*. Help speed the scrap collection effort. Do your part. Armco Drainage Products Association, 905 Curtis Street, Middletown, Ohio. U. S. A.

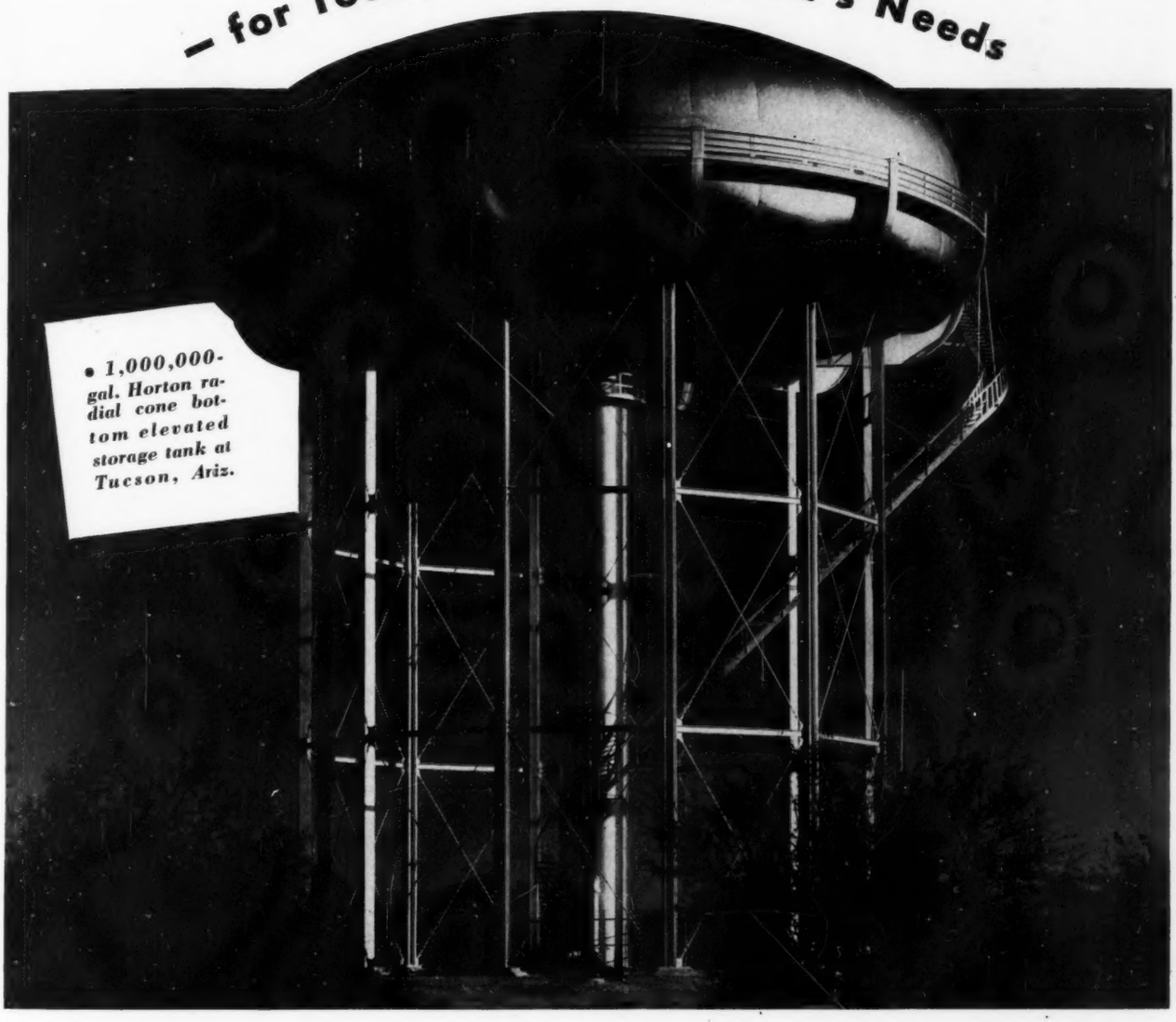
ARMCO

TURN IN ALL YOUR SCRAP

THIS ADVERTISEMENT IS IN SUPPORT OF THE SALVAGE PROGRAM OF THE CONSERVATION DIVISION OF THE WAR PRODUCTION BOARD.

DEPENDABLE ELEVATED STORAGE

— for Today's and Tomorrow's Needs



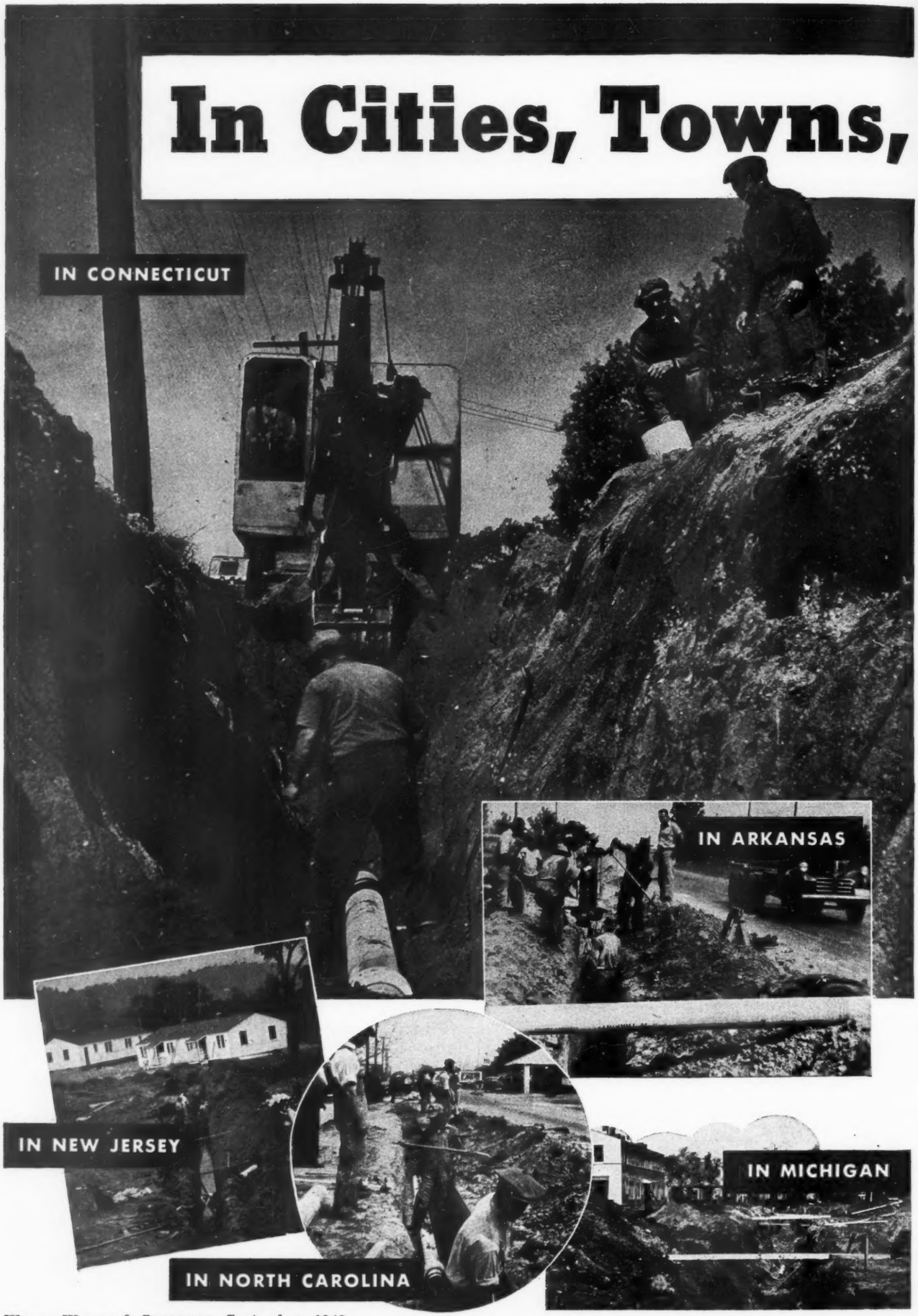
FORESIGHTEDNESS comes close to being a creed with many waterworks engineers. Because of this trait, numerous municipalities today are reaping the benefits of having water supply systems able to take on new industrial and domestic loads without addition of more equipment, with no sacrifice of fire protection service, and without adverse effect on distribution pressures or pumping costs. All of these benefits are made possible by *adequate* elevated water storage facilities — facilities that will protect cities for years to come.

It is also a matter of foresight to make careful note now of the performance of *elevated water storage* under the stress of wartime emergencies. *In times of war, prepare for peace.*

CHICAGO BRIDGE & IRON COMPANY

Chicago.....2193 McCormick Bldg.	Birmingham..1586 North 50th Street	Philadelphia...1644-1700 Walnut St.
New York.3390-165 Broadway Bldg.	Tulsa.....1646 Hunt Bldg.	Washington...632 Washington Bldg.
Cleveland.....2262 Guildhall Bldg.	Houston.....5615 Clinton Drive	San Francisco.....1083 Rialto Bldg.
Havana.....402 Edificio Abreu	Detroit.....1551 Lafayette Bldg.	Greenville.....York Street

Plants at BIRMINGHAM, CHICAGO, and GREENVILLE, PA. *In Canada:* HORTON STEEL WORKS, LIMITED, FORT ERIE, ONT.


In Cities, Towns,
IN CONNECTICUT
IN ARKANSAS
IN NEW JERSEY
IN NORTH CAROLINA
IN MICHIGAN

Villages . . .

For Water Lines . . . *more and more communities of all sizes are adopting J-M Transite Pipe for efficient, economical water transportation. Check these advantages:*

Easy Handling . . . Transite Pipe is light in weight . . . handling requires fewer men. Mechanical equipment is needed only for the larger sizes.

Rapid Assembly . . . Transite Pipe is assembled with the Simplex Coupling, consisting of a Transite sleeve and two rubber rings. No heating or pouring operations are necessary. And even unskilled crews can form tight joints quickly and easily.

Tight, Flexible Joints . . . Simplex Couplings provide tight, flexible joints. Finished joints are checked by gauging the position of the rubber rings. Deflections up to 5° are possible at each joint . . . permitting wide sweeps to be made with straight lengths of Transite.

High Corrosion-Resistance . . . This feature of Transite's asbestos-cement composition means long service with minimum upkeep.

Tuberculation Impossible . . . Possessing an unusually smooth bore, Transite has a flow co-efficient of C-140. Being non-metallic, Transite maintains its high delivery capacity because it can't tuberculate.

For complete details, write for Transite Pressure Pipe brochure TR-11A. And for information on the many ways Transite Sewer Pipe reduces sewage disposal costs, send for brochure TR-21A. Johns-Manville, 22 E. 40th St., New York, N. Y.

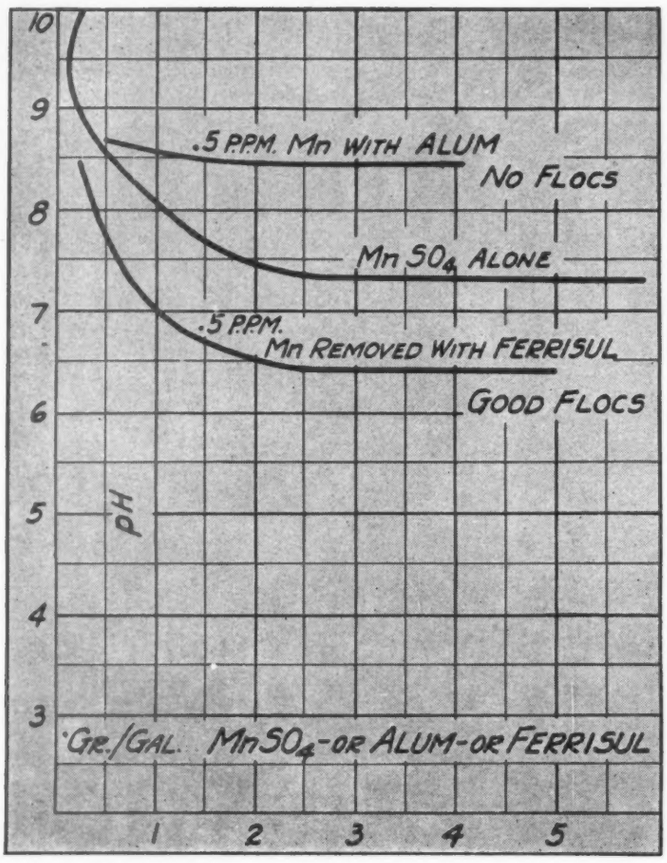
Johns-Manville

JOHNS MANVILLE JM PRODUCTS

Transite Pipe

AN ASBESTOS PRODUCT

For efficient, economical water and sewer lines



These are floc curves of manganous sulfate in distilled water. They show clearly that small amounts of manganese will not floc except at extremely high pHs. They also show that small amounts of Ferrisul substantially increases the floc volume, make settling and filtration efficient and make it possible to use pHs well within practical limits.

Here is graphic proof of Ferrisul's easy-handling and keeping qualities. The Ferrisul in this hopper was taken directly from a 60-ton lot which had been stored in a steel bin for five years. Yet when this picture was taken it was as dry and free-flowing as the day it was delivered!

Sure, Simple Cure for "Black Water" Troubles

In soft, impounded water supplies, these fall months are the danger months for manganese—and "black water" troubles.

In such types of water, therefore, these fall months call for special treatment with Ferrisul (anhydrous ferric sulfate.)

To precipitate manganese, frequently present in solution in the manganous state when oxygen content is low, it must first be oxidized to the manganic condition—and four facts about Ferrisul make it the ideal agent for this otherwise difficult treatment problem.

1. Ferrisul has a mild oxidizing action.

2. It is an efficient coagulant at the pH required to speed the oxidizing reaction.

3. It forms a dense floc which absorbs the precipitated manganic oxide.

4. It produces water of lower residual manganese content than any other process now known.

The prescribed dosage calls for eight to twenty-five parts per million of Ferrisul plus lime to yield a pH of 9.0 or slightly lower. While the exact dosage varies with the individual water, the pH of treatment is relatively constant and is usually very close to the proper pH of stabilization, thus eliminating the need for pH correction in the clear well. The cost of treatment is comparable with average treatment costs and considerably less expensive than other methods for this special treatment.

Manganese removal is just one of scores of water and sewage treating problems to which Ferrisul provides a simple, economical solution. Easy to handle and store, Ferrisul can be transferred on any standard conveyor system and introduced into the system either by dry feeding or solution. It is shipped in bags or barrels which can be stored indefinitely without deterioration. Bulk shipments are made in Dry-Flo cars as easy to unload as tank cars carrying liquid.

For details and technical advice on the use of Ferrisul and other water treating chemicals of the Merrimac Division, inquire: MONSANTO CHEMICAL COMPANY, Merrimac Division, Everett Station, Boston, Massachusetts.

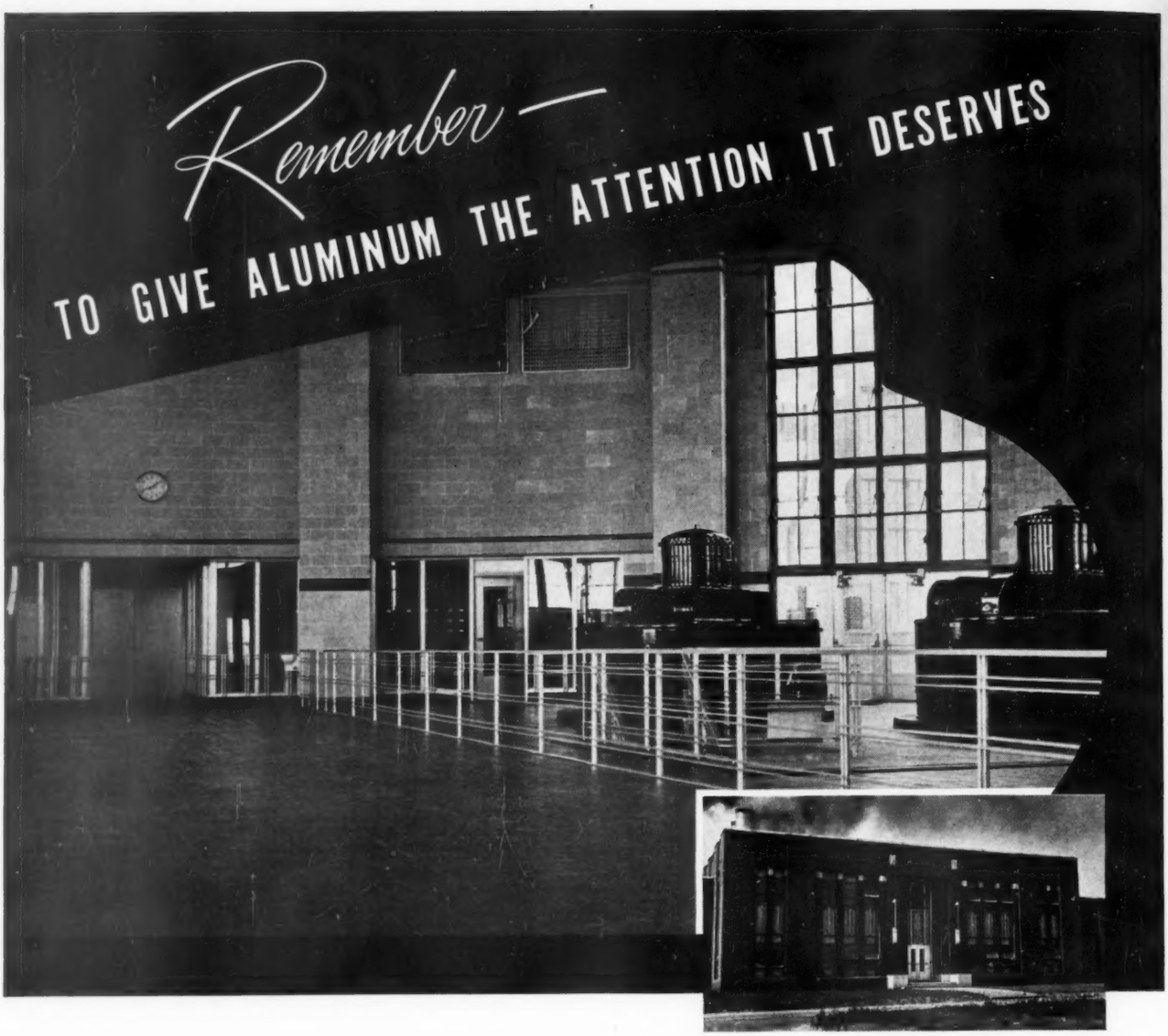
MONSANTO CHEMICALS

SERVING INDUSTRY...WHICH SERVES MANKIND

Ferrisul

for better, more efficient water and sewage treatment

Not by Choice
BUT BY NECESSITY AND A PATRIOTIC PRIVILEGE OF DUTY!
Here at the plant of the Mueller Brass Co. every special skill and facility that we possess has been turned to the one main essential purpose of winning the battle of armament production in supplying those things which Uncle Sam requires of us.
Naturally, this is not by choice, but by necessity and a patriotic privilege of duty. We didn't want war business . . . we wanted to keep our peace time markets—to keep on supplying STREAMLINE copper pipe and fittings to the plumbers, steamfitters and water works men of America.
But now our plant is engaged 100% in the production of war materials. Brass and bronze are safeguarding the life of the nation, but after peace is won, we will again manufacture and supply an even better STREAMLINE copper pipe and fittings.
We know that the going now is tough for many of our former good customers—they're doing their part, too, to the best of their ability. There are many restrictions to practically all available business. If you have a problem, it's more than likely that we can help. Write us—we'll appreciate it.
MUELLER BRASS CO.
PORT HURON, MICHIGAN
E
WINNERS OF NAVY "E" AWARD



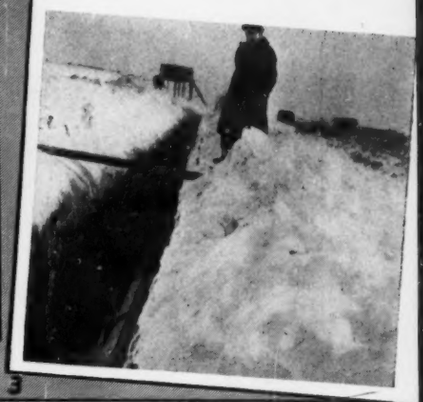
The decorative Aluminum in your water treatment or sewage disposal plant simplifies your maintenance work. It is easy to keep bright and shining, offering visible proof to visitors that you're very much on-the-job.

Hand and stair rails, window sills, light reflectors, equipment and instrument housings, and similar parts, often have an Alumilite finish (process patented). An occasional dusting with a dry cloth, or washing with mild soap and water, may be all they need to maintain their original brightness. The booklet, "Instructions for the Protection and Maintenance of Alumilite Finishes and Alzak Reflectors," contains much helpful guidance.

The Aluminum Alloy equipment in your plant, installed primarily as a barrier against corrosion, also helps make upkeep easier. Of course, Aluminum window frames, skylights, coping, spandrels, air ducts, and the like, should be cleaned occasionally. This gets rid of moisture-holding pockets of dust and debris that accumulate in corners, and which might cause trouble.

Are you wondering how to get maximum life from the irreplaceable Aluminum Alloys throughout your plant? Alcoa engineers are always ready to help you get the answer. Write ALUMINUM COMPANY OF AMERICA, 1955 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALCOA ALUMINUM **ALUMINUM**



1 — Part of the Wichita Water Supply Project referred to below Note pouring gates — chipped off after joint has been poured.

2 — 12' lengths of 4" bell & spigot pipe, jointed with Tegul-MINERALEAD to form a span 19' between supports. Joint centered under power hammer of beam with 50 lb. iron chunk head. This "hammer" delivered 90,000 smashing impacts in 15 hours of continuous action. Throughout the test 90 lbs. water pressure was maintained in pipe and at the end there wasn't even a suspicion of leakage.

3 — Zero to 36° below may be tough with some compounds, but not with Tegul-MINERALEAD. At the thermometer's other extreme Tegul-MINERALEAD is probably the only practical compound used in lines carrying hot water.

In Laying BELL & SPIGOT WATER LINES

Save Time

Because of the inclusion of Thiokol (synthetic rubber) in its sulphur base, joints made with *Tegul*-MINERALEAD show less initial leakage • Our contractor customers have laid lines with pipe of all sizes up to 48" in which, upon application of the water pressure, leakage was far below the maximum allowed in engineer's specifications • Using *Tegul*-MINERALEAD you save days that would otherwise be lost waiting for leakage to clear up • There need be no delay in back-filling trenches; premises can be tidied up — traffic hazards done away with.

Save Trouble

Tegul-MINERALEAD is five times lighter than lead and goes three times as far • Make joints permanently tight, standing up under vibration of constant railroad and highway traffic, and heavy machinery operating nearby • *Tegul*-MINERALEAD has extraordinary resistance to thermal shock and is found entirely satisfactory in lines carrying water at alternately high and low temperatures, where other compounds have failed.

Tegul-MINERALEAD is easy to use, needs no caulking or deep bell holes. Melting pot is replenished while work proceeds • Coming in 10 lb. ingots, *Tegul*-MINERALEAD is easy to handle, ship and store • Important too — there can be no possible change in composition between factory and job. No amount of jolting in transit can shake down the heavier components of this compound.

Save Money

No skilled labor; no damage from moisture, even if flood-submerged for a long period. No loss through change of composition since, as already stated, this cannot occur in the ingot form.

GREATER ADHESION — *Tegul*-MINERALEAD has greater adhesion to metallic and ceramic surfaces and a lower coefficient of expansion than is found in unplasticized sulphur cements.

TESTED BEFORE SHIPMENT — Every batch of *Tegul*-MINERALEAD is sampled and tested before it is accepted for shipment.

Tegul-MINERALEAD

Our technical literature includes the story of the WICHITA WATER SUPPLY PROJECT of 1939-1940—33 miles of B. & S. Main (including 22 miles of 48" diameter pipe) completed and in service in thirty-eight weeks. Specifications allowed max. leakage of 100 gals., per inch, per mile. Actual leakage two weeks after water was turned into line was 39 gals., per inch, per mile. Tegul-MINERALEAD (325,000 lbs.) was the jointing compound used.

The ATLAS MINERAL Products Company OF PENNA.

Mertztown — Pennsylvania

THE House Jointing Material

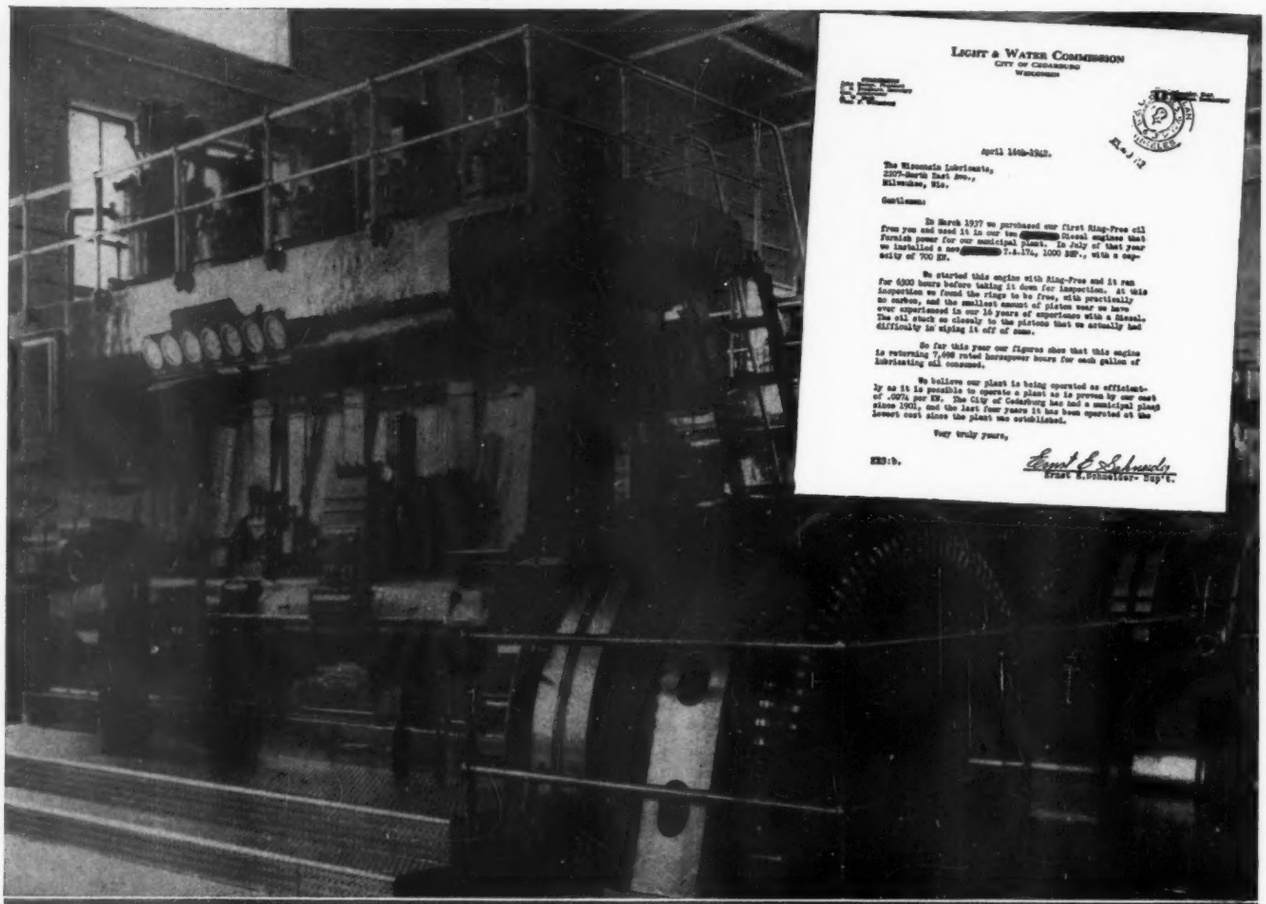
*ATLANTA, Ga. 175 Spring St., S.W.
*CHICAGO, Ill. 333 No. Michigan Ave.
*DALLAS, Tex. 3921 Purdue Street
*DETROIT, Mich. 2970 W. Grand Blvd.
*KANSAS CITY, Kan. 1913 Tauromee Ave.
NEW YORK CITY, 280 Madison Ave.
PITTSBURGH, Pa. (10)4656 Old Boston Rd.
TORONTO, Ont., McRae Engineering Equipment, Ltd. 11 King St., West

The ATLAS MINERAL Products Company of California
REDWOOD CITY, California

*DENVER, Colorado, 1921 Blake Street
*HONOLULU, Hawaii, U.S.A.
*LOS ANGELES, Cal., 817 Yale Street
*SEATTLE, Wash., H. D. Fowler Company 558 First Avenue, South

Stocks carried at these points

For more information and literature, write us here at Mertztown, or address Atlas Representative in city nearest you.



LIGHT & WATER COMMISSION
CITY OF CEDARBURG
WISCONSIN

April 16th 1942.

The Wisconsin Lubricants,
2307 North East Ave.,
Milwaukee, Wis.

Gentlemen:

In March 1937 we purchased our first Ring-Free oil from you and used it in our two [redacted] Diesel engines that furnish power for our municipal plant. In July of that year we installed a new [redacted] 7-A-176, 1000 BHP., with a capacity of 700 KW.

We started this engine with Ring-Free and it ran for 6300 hours before taking it down for inspection. At this inspection we found the rings to be free, with practically no carbon, and the smallest amount of piston wear we have ever experienced in our 16 years of experience with a Diesel. The oil stuck so closely to the pistons that we actually had difficulty in wiping it off of some.

So far this year our figures show that this engine is returning 7,698 rated horsepower hours for each gallon of lubricating oil consumed.

We believe our plant is being operated as efficiently as it is possible to operate a plant as is proven by our cost of .007¢ per KW. The City of Cedarburg has had a municipal plant since 1901, and the last four years it has been operated at the lowest cost since the plant was established.

Very truly yours,

EEB:b. Ernst E. Schneider
Chief Engineer- Supt.

1 Gallon to every 7,698 H.P. hours

THAT'S the average oil consumption recorded by The City of Cedarburg, Wisconsin so far this year.

The experience of the Light & Water Commission of Cedarburg is the subject of an article in August Diesel Progress where detailed figures, giving full credit to RING-FREE are given.

"The results have surpassed expectations," says Diesel Progress. "Not once in all the years of operation have the operators found a stuck ring. Careful records are kept of all maintenance work and they show that cylinder wear has been exceedingly small."

The Cedarburg authorities give a striking instance of the performance of RING-FREE in their letter of April 16, 1942. They started a new engine with RING-FREE "and it ran for 6300 hours before taking it down for inspection. At this inspection we found the rings to be free, with practically no carbon, and the smallest amount of piston wear we have ever experienced in our 16 years of experience with a Diesel," says Ernst E. Schneider, Superintendent.

Read the complete story in Diesel Progress for August, then write us.

MACMILLAN
PETROLEUM CORPORATION
50 West 50th Street, New York
624 South Michigan Ave., Chicago
530 West 6th Street, Los Angeles

MACMILLAN
RING-FREE
MOTOR OIL

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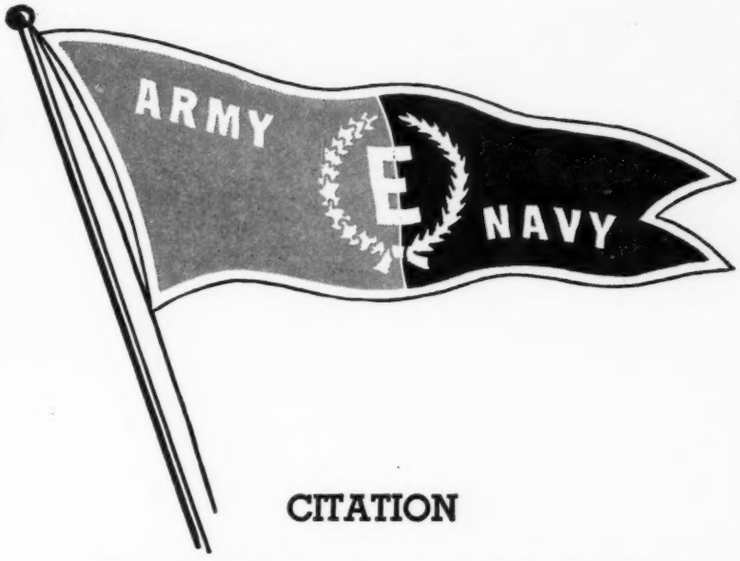
Macmillan Petroleum Corporation

TO THE MEN AND WOMEN OF

BUILDERS IRON FOUNDRY

THE ARMY-NAVY PRODUCTION AWARD



CITATION

..."a Nation's tribute to the spirit of patriotism and high achievement in production of war equipment, exceeding all expectations"

BUILDERS IRON FOUNDRY

(BUILDERS-PROVIDENCE, INC.)

PROVIDENCE . . . RHODE ISLAND

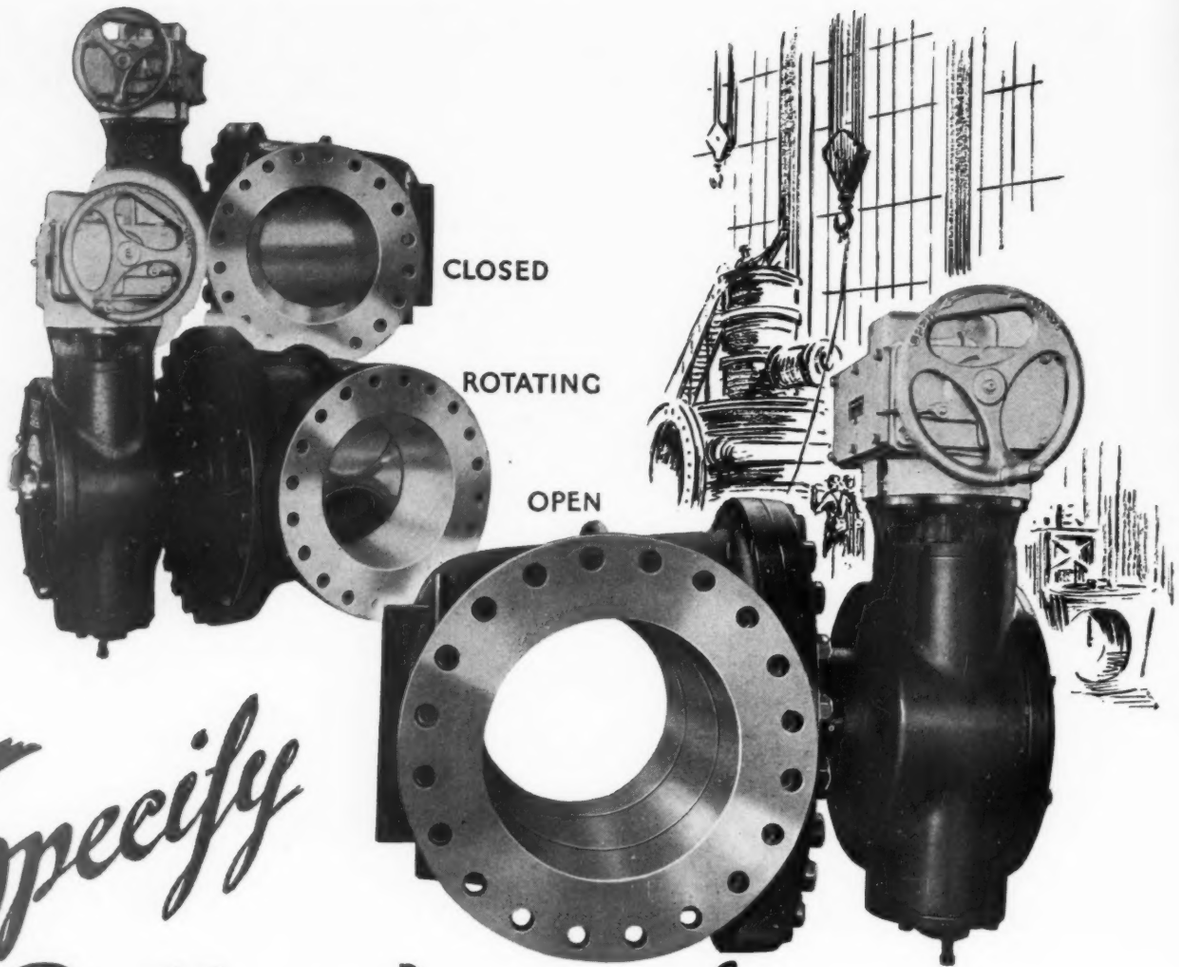
★ ★ ★

Contributors to the Nation's Peace and War Effort since 1820

BUILDERS

WATER AND SEWAGE WORKS

Equipment



Specify Rotovalves for Maximum Operating Advantages

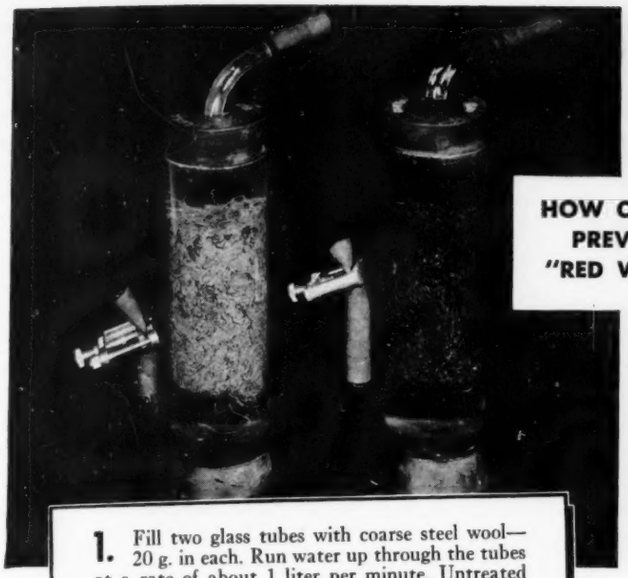
CONSULTING ENGINEERS, Officials and all other Waterworks men, regardless of how simple or complicated your problem is, you'll find your solution in SMITH ROTOVALVES!

For here is a cone valve design in which the plug:

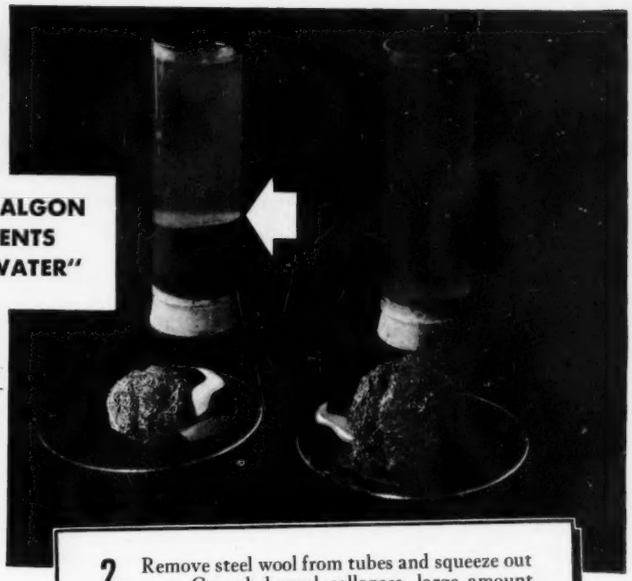
lifts, rotates and seats . . . assures through, unobstructed flow . . . provides minimum loss, as the loss through a Rotovalve, when open, is no greater than it is through a pipe of equal diameter and length . . . is obtainable in sizes and with control mechanisms meeting a wide range of services . . . may be operated by either manual or hydraulic means, or combined motor and manual mechanism as shown . . . supplies quick, positive operation!

The swing to Smith Rotovalves is unmistakable, as proven by installations in modern water works and new systems for Plants producing war materials. Specify SMITH ROTOVALVES in your next job!

S. MORGAN SMITH COMPANY YORK, PA.



HOW CALGON PREVENTS "RED WATER"



1. Fill two glass tubes with coarse steel wool—20 g. in each. Run water up through the tubes at a rate of about 1 liter per minute. Untreated water on left, water treated with 4 ppm. Calgon* on right. Watch heavy rust progressively clog the steel wool in untreated water during a couple of days, while steel wool in Calgon-treated water remains practically undamaged.

2. Remove steel wool from tubes and squeeze out rust. Corroded wool collapses, large amount of rust (see arrow) is left. This is the way corrosion forms "red water" in your mains. Wool protected by Calgon remains springy; only a little rust is seen.

Does "Red Water" give you Monday morning blues?

(HOW TO GET RID OF THEM)

WHEN wash day rolls around does your phone jangle with complaints of "red water"? If so, you will lend a sympathetic ear to how Calgon can put a stop to this trouble once and for all.

Whether the "red water" is caused by corrosion or by dissolved iron from well water, Calgon can stop it. Here is how it works.

When Calgon is added to water it forms a thin protective film on the surface of the pipes. This film decreases corrosion sufficiently to eliminate "red water."

Similarly, when Calgon is added to a well water containing dissolved iron no precipitation occurs, the water remains clear and "red water" is eliminated.

The amount of Calgon* used is always small, but varies in different plants due to individual conditions. A high initial feed is desirable, and this is gradually reduced as protection is developed. Of principal importance is the fact that the amount of Calgon is so small that the cost is well within your budget.

Are your "red water" troubles due to corrosion or dissolved iron? Tell them to us and let us tell you what Calgon will do to cure them.

**Calgon is the registered trade-mark of Calgon, Inc. for its glassy sodium phosphate products.*

Calgon

solves 4 water works problems

1. **Prevention of scale** from hard, high-bicarbonate waters. Calgon, added at the plant, prevents scale formation in mains, meters and hot-water heaters, throughout the system.
2. **Corrosion control** — Calgon forms a thin protective film on metals and metal oxides at pH values of 5.0 and higher. This reduces the attack of oxygen to such an extent that corrosion ceases to be a problem.
3. **Prevention of "red water"** — Calgon prevents the precipitation of dissolved iron. Thus "red water," either from iron initially present in well water, or from corrosion, can be eliminated.
4. **Stabilization of water** following lime or lime-soda softening. Calgon's ability to prevent precipitation of calcium carbonate stabilizes water to the ends of the system.

Calgon, Inc.
Hagan Building, Pittsburgh, Pa.
Gentlemen:
Please send complete information about Calgon for Preventing "Red Water" ☐ Control of Corrosion ☐ Scale Prevention ☐ Stabilization of water.

Name_____

Company_____

Address_____

City_____ State_____

calgon, inc.

HAGAN BUILDING PITTSBURGH, PA.

88 years
OF PROGRESSIVE STORAGE TANK ENGINEERING!

Established in 1854, the R. D. Cole Mfg. Co. has long been recognized as one of the nation's outstanding tank builders. With 88 years of "progressive storage tank experience" at your disposal, we will welcome the opportunity to serve your tank needs.

ALL SHAPES AND SIZES

The R. D. Cole Mfg. Co. has developed a complete line of elevated steel tanks for water supply, both for domestic service, and sprinkler requirements, ranging in capacity from 5,000 to 2,000,000 gallons. The designs include the standard Hemispherical and Self-supporting bottom, the "Cole Ovaloid", Standpipe, and many individual styles involving architectural treatment to satisfy local conditions, or to provide special shapes for advertising purposes.

STORAGE TANKS

Pressure tanks for storage of gas from digestors at sewage disposal plants so that excess output at peak loads can be used during off-peak periods. Chemical storage tanks, hot water storage tanks, tanks for bulk storage of oils and gas.

CONSTRUCTION FACILITIES

Fabricated steel plate—the R. D. Cole Mfg. Co. has a fully equipped plant for the fabrication of riveted or welded steel plate. In addition to the construction of its regular line of horizontal return tubular boilers, oil storage tanks, tubular heaters, etc., the company is prepared to construct special tanks and apparatus of any specified metal plate.

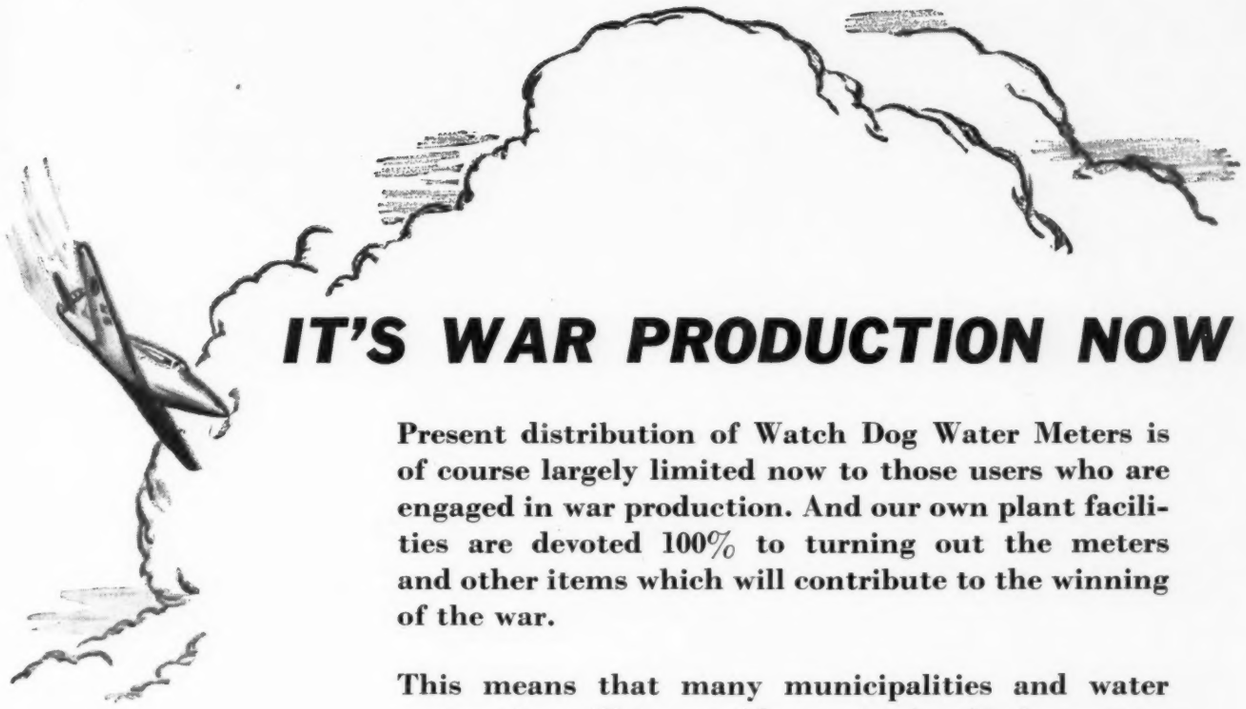
1,000,000-Gallon "Cole-Shallow Depth" Tank

Designs available for any service, made to your specifications or from our designs submitted by our own Engineering Department.

R. D. COLE MANUFACTURING CO.

Established in 1854

NEWNAN « « GEORGIA



IT'S WAR PRODUCTION NOW

Present distribution of Watch Dog Water Meters is of course largely limited now to those users who are engaged in war production. And our own plant facilities are devoted 100% to turning out the meters and other items which will contribute to the winning of the war.

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Our Government requires copper for its direct war effort, and has requested water meter manufacturers to use iron for certain parts of the meters, instead of bronze.

We are prepared to meet this requirement and will furnish our line of various size water meters with iron castings and such other parts of iron as specified by the War Production Board.

You will find all parts interchangeable with your present meters of our manufacture and every known precaution exercised to warrant Accuracy, Simplicity and Durability.

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282-296 SOUTH STREET

NEWARK, NEW JERSEY

District Offices and Representatives in Principal Cities

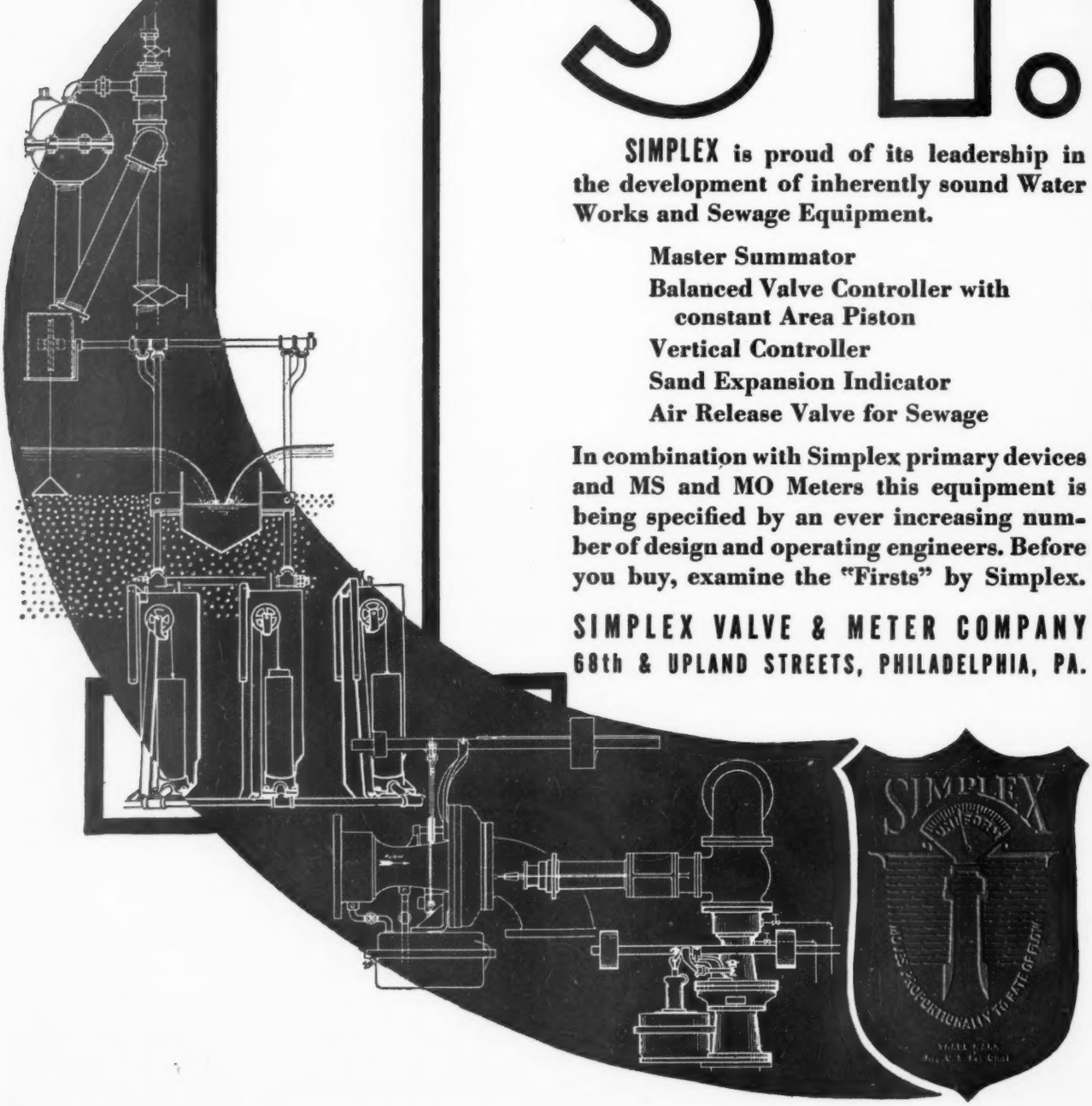
WATCH DOG

WATER METERS

WG2-5

WORTHINGTON-GAMON

1ST.



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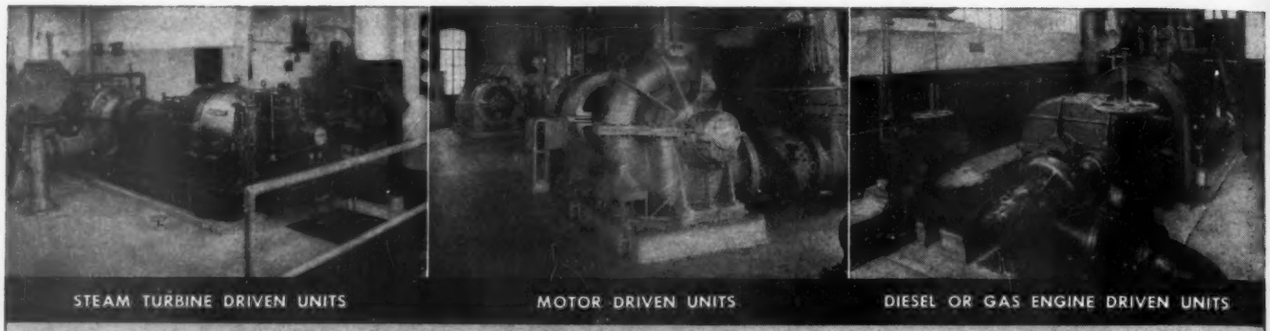

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WATER SUPPLY

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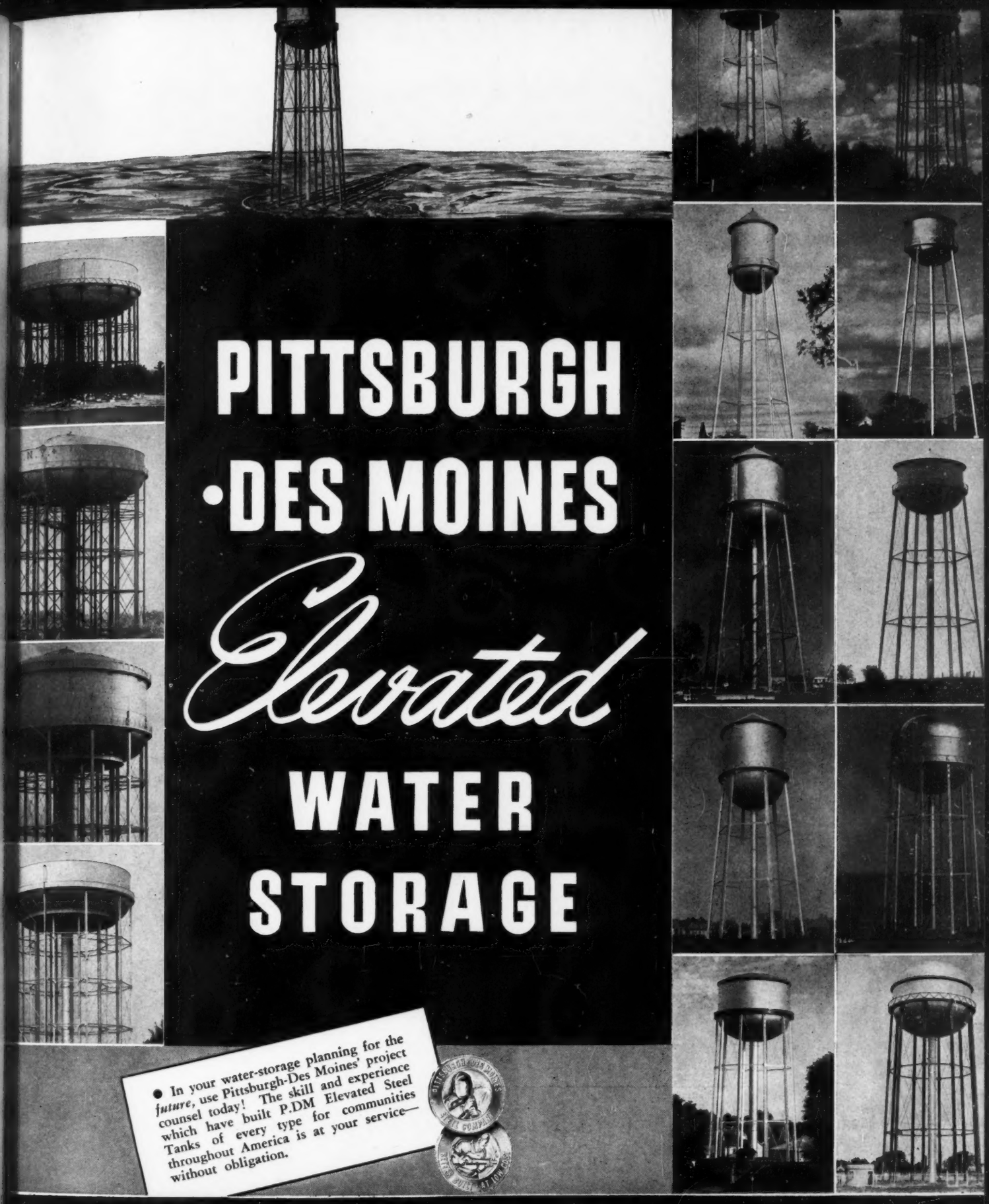

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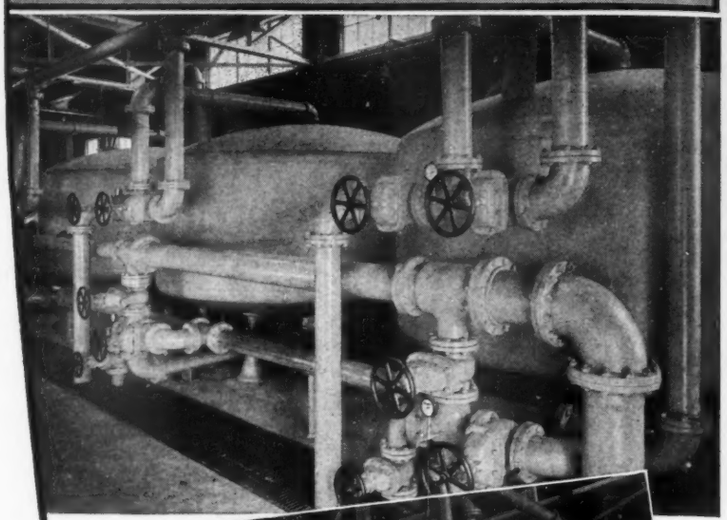

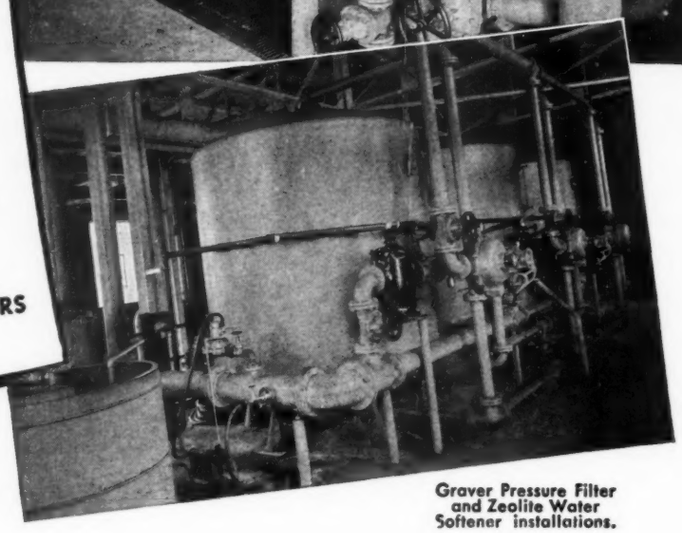

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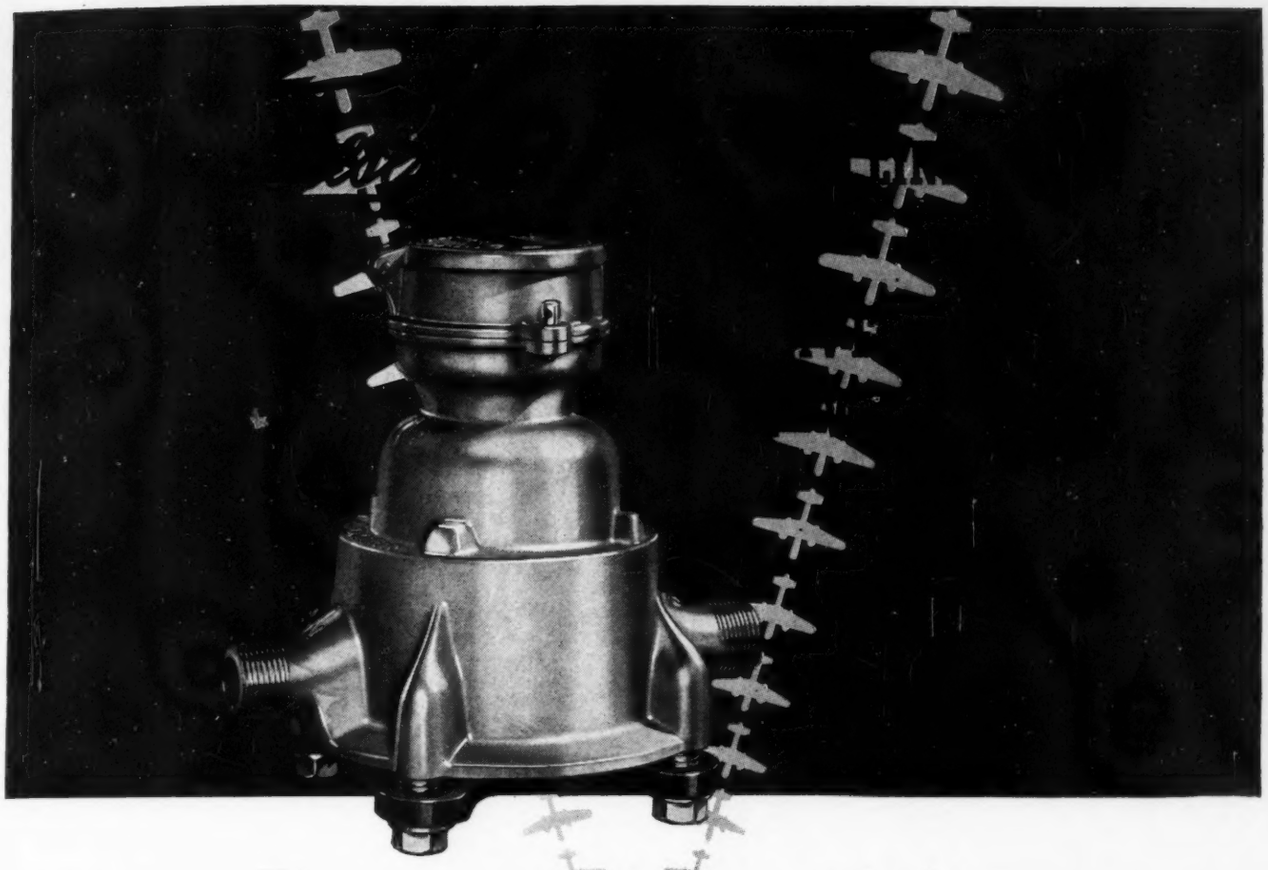

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Badger's 37-years experience in manufacturing dependable, accurate, sensitive, durable water meters is drawn upon in the design of the "Mars" line of meters. It deserves your confidence.

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Conservation of water meters is a patriotic duty. Careful maintenance and repair will reward you with extra years of accurate, dependable operation.

Cleveland's Southerly Plant. See this Plant while in Cleveland.

Conference

ON WAR TIME SANITATION

(THIRD ANNUAL CONVENTION)

Federation of Sewage Works Associations

Meeting Place:—
Hotel Statler, Cleveland, Ohio

Dates:—
October 22nd to 24th, 1942

Chairman of Federation:—
A. S. Bedell, N. Y. State Health Dept., Albany

Chairman Convention Committee:—
Wm. L. Havens, Leader Bldg., Cleveland

Held in Conjunction with:—
Ohio Conference on Sewage Treatment

Exhibits:—
Exhibits by the leading manufacturers of sewerage and sewage treatment equipment, materials and supplies

Subjects:—
Impact of War on Sewage Treatment; Need for Short Training Schools During War Emergency; Operation of Sewage Plants in Military Camps; Wartime Sanitary Problems Facing State Health Depts.; Solving Cleveland's Sewage Problems; Treatment of Chemical Wastes; Sewage Works Priorities; Local Civilian Defense Problems; Sewage Works Maintenance in War Time; Value of Laboratory Tests in Plant Operation

Nationally-known Speakers — Discussions — Symposia

Inspections:—
Inspection of Cleveland's sewage treatment plants

Buffet Luncheon:—
Cleveland Sewage Treatment Plant

Reunion:—
Reunion of newly formed Quarter Century Club of operators

Entertainment:—
In keeping with war conditions, yet enough to permit get-together of friends and co-workers

Ladies Invited:—
Cleveland is an ideal city for pleasure, inspection, shopping and relaxation for wives and friends

Priorities Clinic:—
An important feature of the meeting . . . A clinic, manned by manufacturers' representatives and priority experts will give advice and guidance to members who are faced with equipment and supply problems

THE NATIONAL SEWAGE WORKS MEETING OF THE YEAR

(Space for this advertisement has been donated by
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in cooperation with attendance committee)

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FAST INSTALLATION . . . Transite's long lengths reduce the number of joints needed in the line . . . its light weight permits easier, faster, more economical handling.

LESS INFILTRATION . . . Fewer, tighter joints minimize leakage, cutting down on the load at the disposal plant.

HIGH DELIVERY CAPACITY . . . This advantage of Transite Pipe frequently permits smaller pipe or flatter grades, resulting in shallower trenches.

AVAILABLE BOTH FOR FORCE MAINS AND GRAVITY LINES . . . Complete information is given in brochure TR-21A. And for details on lower-cost water transportation, send for Transite Water Pipe Brochure TR-11A. Johns-Manville, 22 East 40th Street, New York, N. Y.

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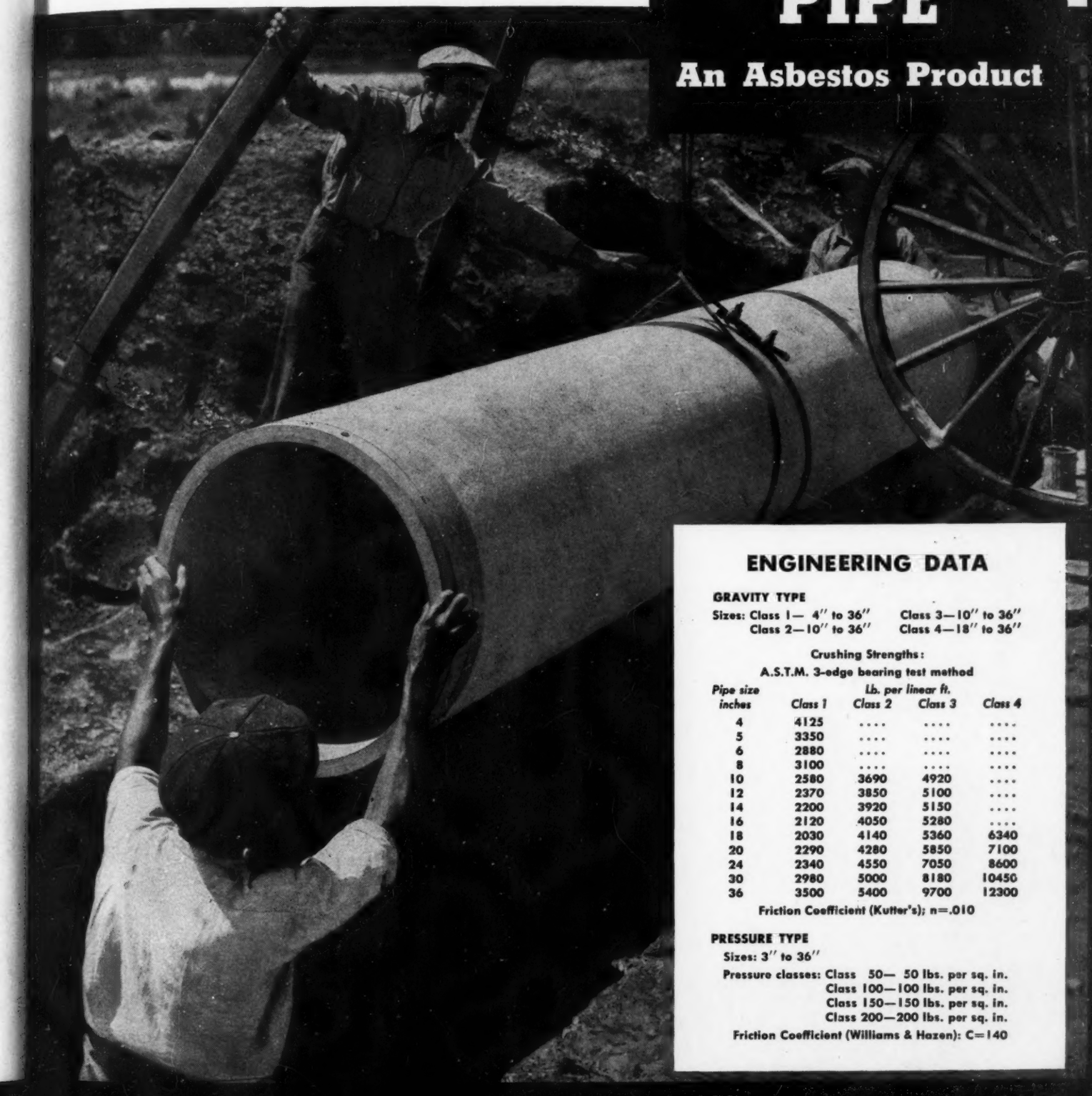
An Asbestos Product



ENGINEERING DATA

GRAVITY TYPE

Sizes: Class 1— 4" to 36" Class 3—10" to 36"
Class 2—10" to 36" Class 4—18" to 36"

Crushing Strengths:

A.S.T.M. 3-edge bearing test method

Pipe size inches	Lb. per linear ft. Class 1	Class 2	Class 3	Class 4
4	4125	....	....	....
5	3350	....	....	....
6	2880	....	....	....
8	3100	....	....	....
10	2580	3690	4920	....
12	2370	3850	5100	....
14	2200	3920	5150	....
16	2120	4050	5280	....
18	2030	4140	5360	6340
20	2290	4280	5850	7100
24	2340	4550	7050	8600
30	2980	5000	8180	10450
36	3500	5400	9700	12300

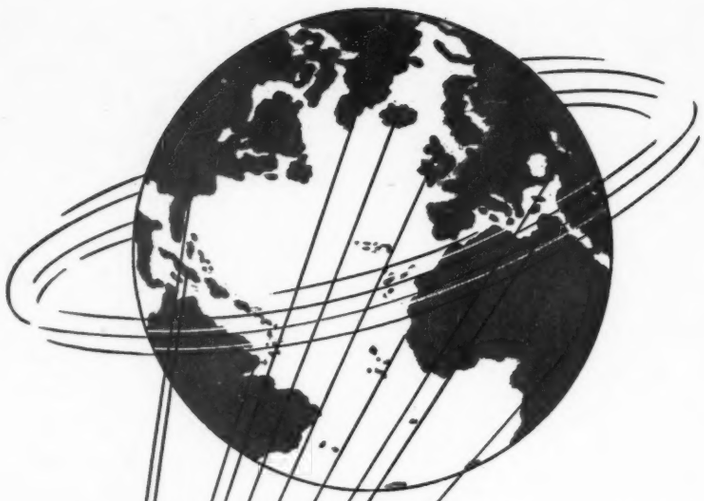
Friction Coefficient (Kutter's); n=.010

PRESSURE TYPE

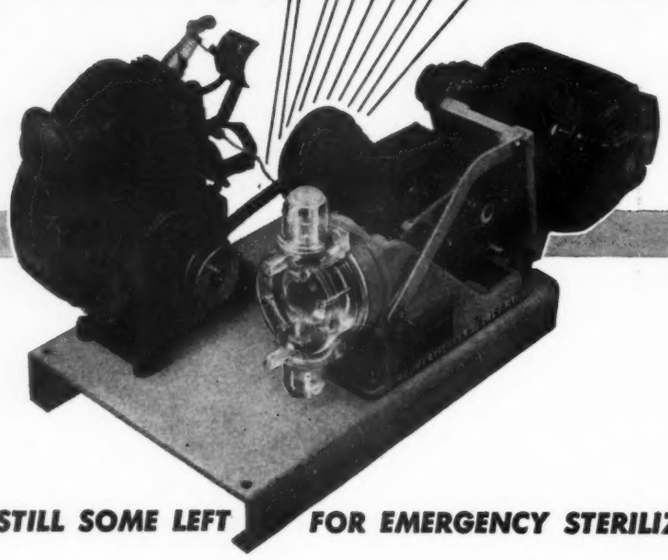
Sizes: 3" to 36"

Pressure classes: Class 50— 50 lbs. per sq. in.
Class 100—100 lbs. per sq. in.
Class 150—150 lbs. per sq. in.
Class 200—200 lbs. per sq. in.

Friction Coefficient (Williams & Hazen): C=140



GLOBAL WATER PROTECTION FOR THE MEN OF OUR ARMED FORCES...



AND STILL SOME LEFT FOR EMERGENCY STERILIZATION!

One of the interesting stories to be told after the war is that of the efforts made to protect the health of our armed forces as they fought all around the Globe. % Proportioneers % is proud that their equipment is doing its share in safeguarding drinking water supplies at bases, forts, camps, and with forces on the march.

We are happy, too, that some of our facilities are available for emergency duty on the home front. The Dual Drive Chlor-O-Feeder illustrated is playing a leading part in this emergency program; actively supported by meter operated main sterilizers, all hydraulic feeders, and the Blitz-Buggy trailer unit.

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"EMERGENCY CHEMICAL FEEDER HEADQUARTERS"

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9N Codding St. **Providence, R. I.**

WATER WORKS & SEWERAGE

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EDITORIAL OFFICE
155 East 44th Street, New York, N. Y.
L. H. Enslow, Editor

COMING!

"Mechanical-Electrical Maintenance of Sewage Plants"

Is an extremely timely contribution in a period when effective and continuous maintenance and repair programs at water and sewage plants has never before rated the importance that it does today. The manifold uses of welding methods used in rehabilitating worn or damaged parts of equipment in the Twin-Cities Sewage Treatment Plant is an outstanding example of what can be accomplished with a minimum requirement of skilled labor and materials. This, however, is just one of the many economy and conservation producing maintenance practices at the St. Paul plant, recounted by—

STANLEY J. LARSEN, Mechanical Eng'r,
The Minneapolis-St. Paul Sanitary District.

"Tank Maintenance—Good and Bad Practices"

Is a recital of some sad experiences of several small cities that contracted for repairs and repainting of elevated tanks, only to find themselves in the grip of a treasury fleecing racket. Because of the growing number of such cases this paper was placed on the A.W.W.A. program in Chicago. In printing it in our next issue we hope that what to avoid in tank maintenance, and what to do, will reach the eyes of many readers. The author is—

WALKER B. DAVIS, Counsel,
Chicago Bridge and Iron Co., Chicago.

"Operating the Bourne Water District"

Is a New England story intended for this New England Water Works Convention Number but unfortunately received too late to have the cuts made to illustrate the article. It tells of problems and practices somewhat out of the ordinary in operating a system which supplies a large number of resort homes in summer and carries a load of only 40% during the winter months. Learning how water rents are collected for a full year *in advance* will make many water works managers want to hire this author—

CHAS. J. CRUMP, Supt.
Bourne Water Distr., Monument Beach, Mass.

"The Present Status of Biofiltration"

Is reviewed in an article, based on experiences in design, operation, performance and results from many of the 150 sewage treatment plants now employing the high rate-high capacity "Biofiltration" process. In the forthcoming article a new chapter is written, based on wide-spread observations and tests leading to improved design, operating economies, higher efficiencies, and a clearer conception of the basic underlying factors in the "Biofiltration" process. The author, whose articles always seem to "click," is—

A. J. FISCHER, Chem. Eng'r,
Development Dep't of the Dorr Co.

"The New Filtration Plant of Newport News, Va."

Was rushed through to supply water to Newport News and the contiguous defense area. This plant which got under construction with what was then considered a top rating of A-3 went to A-1-a and now ends with a rating of AA-3. The plant designer and author is—

REEVES NEWSOM, Consulting Engr.
New York City.

"Experiences in Manganese Removal"

Will appear at a time when the seasonal manganese problem is just around the corner, so to speak, for many dealing with impounded and stored waters. At Durham, N. C., several methods have been tried in manganese trouble times, and the recital of experiences with ferric sulphate as the coagulant, in lieu of permanganate of potash, and the greater efficacy and economy of the ferric coagulation in conjunction with prechlorination should prove helpful to many operators. The author is—

ROBERT S. PHILLIPS, Chief Chemist,
Dept. of Water and Sewerage, Durham, N. C.

VOL. 89, NO. 9 — SEPTEMBER, 1942

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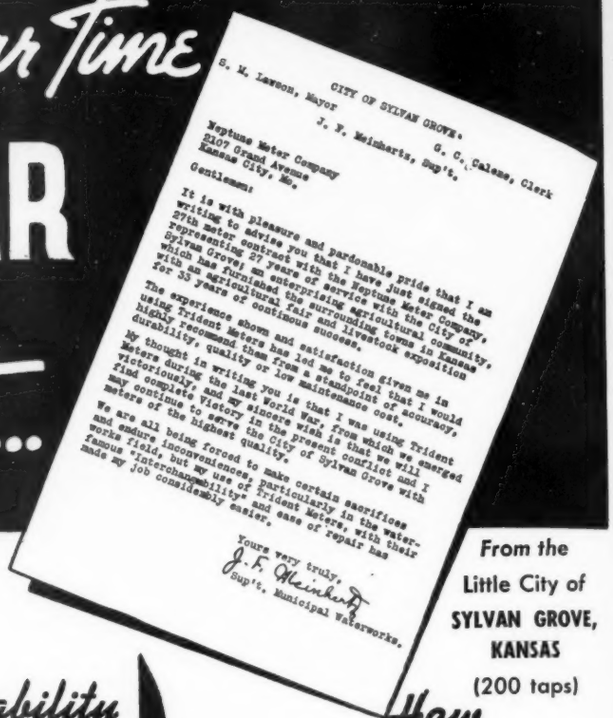
Trident Meters in War Time

"IN THIS WAR as in the last..."



CITY OF SYLVAN GROVE.

S. M. Lawson, Mayor — G. C. Calesa, Clerk

J. F. Meinhartz, Sup't.

Neptune Meter Company
2107 Grand Avenue
Kansas City, Mo.

Gentlemen:

It is with pleasure and pardonable pride that I am writing to advise you that I have just signed the 27th meter contract with the Neptune Meter Company, representing 27 years of service with the City of Sylvan Grove. We are surrounding agricultural community, which has furnished the surrounding towns in Kansas with an agricultural fair and livestock exposition for 39 years of continous success.

The experience shown and satisfaction given me in using Trident Meters has led me to feel that I would highly recommend them from a standpoint of accuracy, durability, quality or low maintenance cost.

My thought in writing you is that I was using Trident Meters during the last World War from which we emerged victoriously, and my sincere wish is that we will find complete victory in the present conflict and I may continue to serve the City of Sylvan Grove with meters of the highest quality.

We are all being forced to make certain sacrifices and endure inconveniences, particularly in the water-works field, but my use of Trident Meters, with their famous "interchangeability" and ease of repair has made my job considerably easier.

Yours very truly,
J. F. Meinhartz
Sup't. Municipal Waterworks.

From the Little City of **SYLVAN GROVE, KANSAS** (200 taps)

TRIDENT METERS

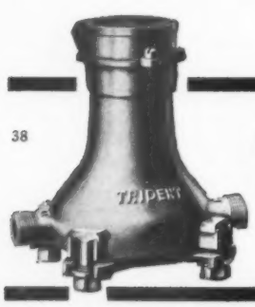
with their famous interchangeability and ease of repair make my job considerably easier"

J. F. MEINHERTZ, *Supt., Municipal Water Works*

Like all other communities, small as well as large, the little City of Sylvan Grove is more than willing "to make certain sacrifices and endure inconveniences," as Mr. Meinhertz writes. Now, more than ever, in these difficult times, Sylvan Grove appreciates "the accuracy, durability, quality and low maintenance cost of Trident Meters" . . . especially in connection with the necessity of maintaining meter accuracy as a means of conserving water, and saving on pumpage, coal, chlorine and other factors vital to the war effort. Sylvan Grove has been a steady buyer of Trident Water Meters for the past 27 years.

How TRIDENT CONSTRUCTION HELPS MAINTAIN *accuracy*

Trident Water Meters are easy to maintain and repair because they are constructed with interchangeable parts, modern units of which fit Tridents even 40 years old. A small inventory in parts takes care of a large installation of Trident Meters. In addition to this, the whole construction of the meter is simple, protected at every point against wear and corrosion.



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Neptune Meters, Ltd., Long Branch, Ontario, Canada.
(Near Toronto)

WATER WORKS & SEWERAGE

VOL. 89, No. 9 *A Gillette Publication* SEPTEMBER, 1942

ROLE OF BACTERIA IN CORROSION

And the Adaptation of Chlorination in the Control of Interior Corrosion of Pipe Lines

By ARBA H. THOMAS
Chief Research Chemist
AMERICAN ROLLING MILL CO.
MIDDLETOWN, OHIO

CORROSION is a process which began when prehistoric man first shaped weapons and other articles from iron and other metals and has played its part in evolution of man from the prehistoric ages up to the present. This process has never ceased as the civilization of man progressed but has been more important because of the wider and accelerating demand for metals for everyday use.

Since iron is comparatively unstable and tends to revert to iron ore or oxide by the process of corrosion, or what we commonly speak of as rusting, the subject of corrosion is extremely important to our present day civilization. As producers and users of iron and steel products, we are aware of the fact that corrosion takes an enormous toll of these products. Our efforts have been to reduce or, if possible, entirely eliminate this destruction and the resulting economic loss.

Most of us have accepted the theory that corrosion of iron or steel is fundamentally of an electrochemical nature. The many variations of metal deterioration and the mul-

Note: This paper was read by Dr. Thomas before the second annual water conference of the Engineers' Society of Western Pennsylvania. By request, its publication has been postponed until the appearance of the conference proceedings.—Ed.

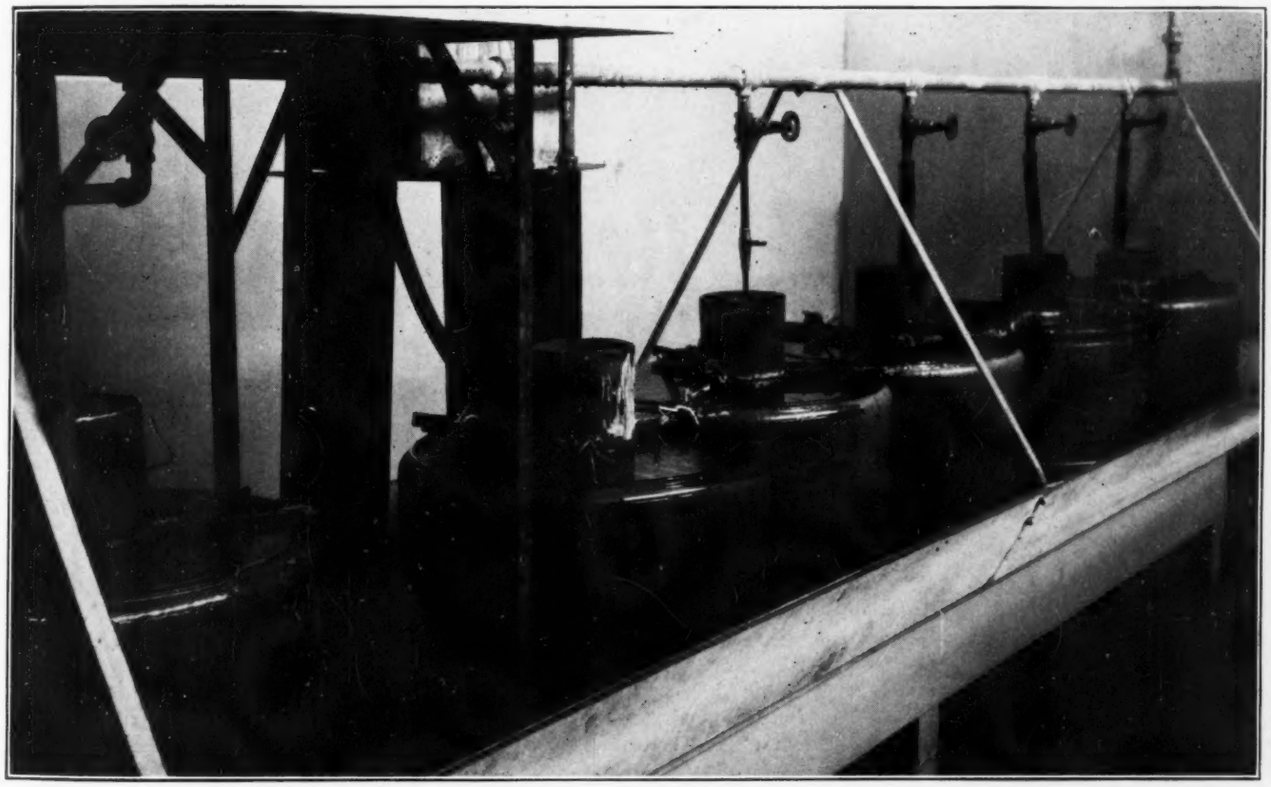


Fig. 1—Battery of Porcelain-Lined Tanks in Corrosion Studies by Armco Research Laboratories

tiplicity of factors governing this deterioration will not be discussed at this time, as a wealth of literature already exists on the subject and it grows daily. The object here is to discuss briefly one of the many conditions that bears upon the corrosion process.

The Nature of Corrosion Bacteria

Bacteria as a possible factor in the corrosion process is not new. It is referred to by Speller (1), Reddick and Linderman (2), Harder (3), and Ellis (4). Yet it has only been during the past few years that the role of bacteria has been given much detailed and systematic study. The Dutch investigator, Von Wolzogen Kühr (5) (6), who made careful and thorough studies of the severe corrosion of steel pipe lines in the wet, high organic lowland soils of the Netherlands, came to the conclusion that this severe corrosion arose from the action of certain types of anaerobic bacteria belonging to the general classification "disulfuricans." These organisms have the ability to reduce sulphates in the soil, evolving hydrogen sulphide, which in turn reacts with the iron pipe. Wolzogen Kühr (6) mentions the fact that Beijerinck as early as 1895 attributed the formation of hydrogen sulphide and iron sulphide in soils to the spirillum, disulfuricans. During the past few years Hadley (7) (8) has made rather extensive studies correlating sulphate reducing bacteria (disulfuricans) and the severe soil-corrosion of pipelines in Ohio and Pennsylvania.

Most bacteria fall into two main groups or classifications—aerobic and anaerobic. Oxygen is essential to the life, growth, and propagation of the aerobic type, while it is "poison" to the anaerobic type. The bacteria responsible for the functioning of the common cesspool are anaerobic, and they cannot function normally in the presence of oxygen.

The exact nature of the organisms associated with the corrosion of steel is still in doubt. Bacteriologists and biologists lean toward the opinion that they are in a state of transition from vegetable to animal life and have characteristics of both. In general, corrosion investigators are neither biologists nor bacteriologists and are content to class all these organisms—plant, animal, or whatever they may be—as "bacteria," although many of the iron-consuming classifications are often classed as algae and slime-formers. The anaerobic organisms that in cer-

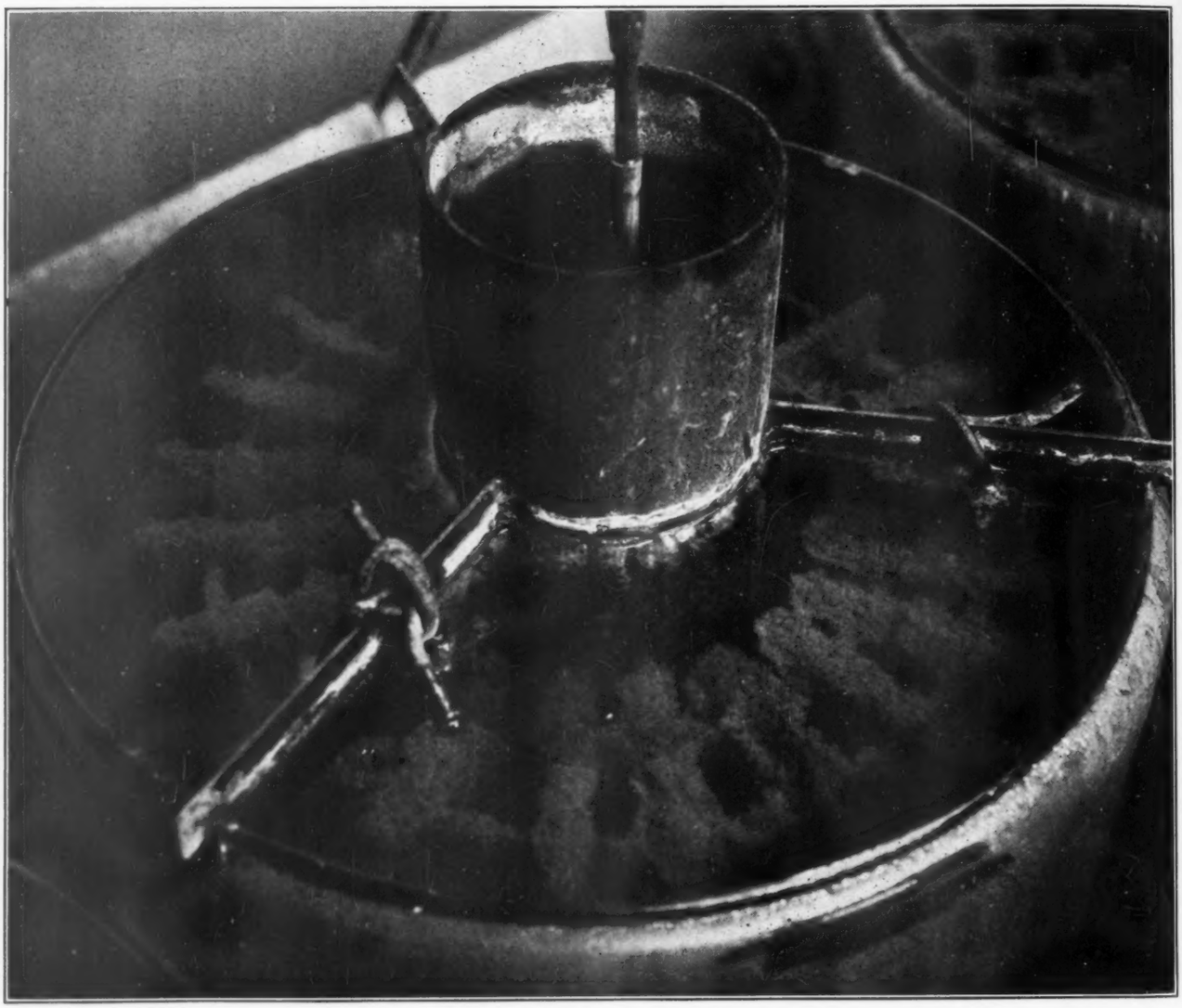


Fig. 2—"A Horrible Example"

One of the most pronounced cases of biologically aggravated corrosion. A deep well water containing but 0.3 ppm. oxygen and otherwise yielding no indication chemically that such conditions were to be expected. A relatively short time earlier these submerged plates were clean and bright. The cause was traced to bacteria and their control proved the corrective.—See Fig. 6.

tain environments have been associated with corrosion fall into two general classifications: "sulphate-reducing" and "iron-consuming."

There are perhaps several species of the "sulphate-reducing" type, but usually most of them are associated with the "disulfuricans." These organisms reduce the sulphates in waters and liberate hydrogen sulphide, which is well known to be severely corrosive to iron. This results in the formation of black ferrous iron sulphide.

Von Wolzogen Kühr's theory is that the hydrogen polarization of the cathodic areas of iron, under anaerobic conditions, is broken down or depolarized by the action of the sulphate-reducing organisms. This cathodic hydrogen is used by the bacteria in reducing the sulphate ion to hydrogen sulphide, which reacts with the ferrous ions, precipitating ferrous sulphide.

It has been pointed out by several investigators (9) (10) (11) that these organisms are undoubtedly responsible for the sulphur content of petroleum, natural gas, and coal. After the giant ferns and mosses of the Carboniferous Age had been covered over with sedimentary deposits these bacteria began to act on the high sulphate seawater brines covering the decomposing organic matter, evolving hydrogen sulphide which ultimately became the sulphur compounds present in our natural underground fuels, such as petroleum, natural gas, and coal.

The so-called "iron-consuming" bacteria do not actually devour metallic iron as a food, but do require ferrous iron for their sustenance and growth. The most common of these organisms—crenothrix, leptothrix, spirophyllum, and the capsulated form cocco-bacilli—consume ferrous iron in aqueous solution, exuding it through their outer skin or cell wall as red ferric hydroxide or a similar insoluble ferric compound.

Peattie in "Flowering Earth" gives a very interesting account of the leptothrix species which, according to most recent geologic and biologic studies, was responsible for the great Mesabi iron ore range along Lake Superior. He traces these bacteria back through the remote geologic past and states that they are the selfsame organisms that lived in the dark, hot, fresh water ocean and are found today in the mineral springs that are heavily charged with iron. Fossils of the leptothrix have been found in Archaeozoic rocks that are about one billion years old. This ancient organism retains its early characteristics to this day. It reproduces simply by dividing one cell into two and has never died. As Peattie says, it is "in body immortal and may outlive all other races." The leptothrix lives in long unpartitioned filaments or tubes that look like root hairs under the microscope. The walls of the tubes consist chiefly of ferric iron deposited around the living organisms by acretion. The bacteria themselves are elliptical in shape and are characterized by "tails." The tubes surrounding the organisms eventually were deposited, building up an ooze that under the terrific pressure of the water above became iron ore. During the geologic ages leptothrix existed the same as now, by consuming ferrous iron and exuding it in the insoluble ferric state.

Ignoring corrosion for a moment, it is interesting to note that our own Charles Lipman discovered in the cores of newly fallen meteorites the remains of bacteria similar to leptothrix. This is the first definite evidence, to my knowledge, of life in planetary space.

The so-called iron bacteria, although not actually consumers of metallic iron, have been found to play important roles in its destruction by corrosion. It is believed that the chief role is indirect or offstage.

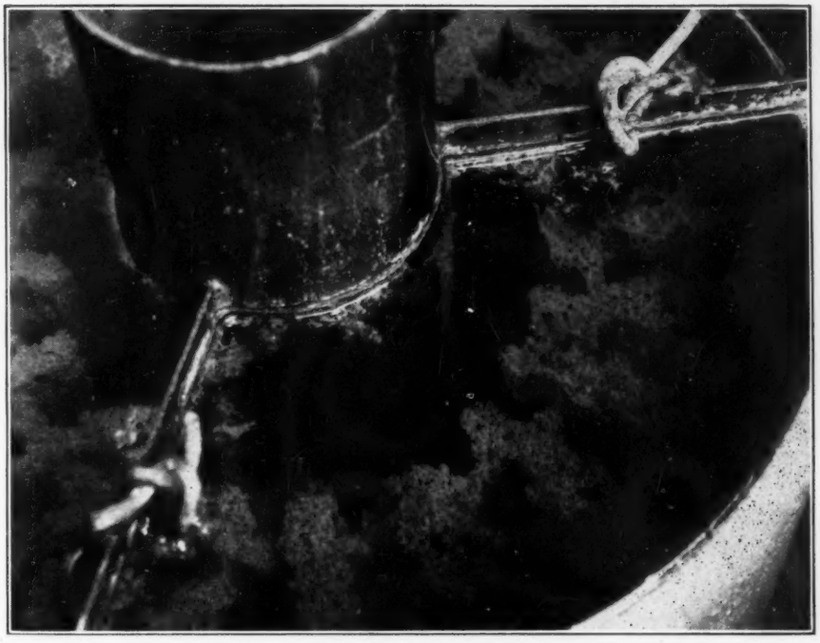


Fig. 2a—An Exceptionally Vivid Close-Up of the Conditions in Fig. 2

Observations in the Field

Being a producer of iron and steel pipe, our company naturally is deeply concerned with corrosion arising from conditions, within and without, which affect pipe lines or water mains. When corrosion occurs in pipe that conducts water, chemical analysis of the water usually indicates the apparent causes of the excessive corrosive attack. Even so, there have been many instances where an ordinary mineral analysis of the water and its corrosivity, as measured by the Langlier Index, would indicate the water to be noncorrosive from a practical standpoint. Several years ago in one of our plants we were troubled by severe corrosion of galvanized piping. When we examined the pipe the inside surface was found to carry a heavy layer of the black iron sulphide. Neither at that time nor for several years were we able to explain this phenomenon. Later, however, especially after Von Wolzogen Kühr reported upon his work in Holland, we were convinced that this sulphide formation was in all probability traceable to the action of sulphate-reducing bacteria of some type.

In another case we encountered severe pitting and perforation of a three-mile water main in the Miami Valley that could not be satisfactorily explained. This line (10 gage or .141 in. wall thickness) carried a

comparatively slow flow during the summer months. During the winter the flow was negligible, setting up a "dead end" condition. Mineral analysis, including the Langlier Index of the water, revealed the water to be non-corrosive. No corrosion had been encountered in other localities where there was normal flow. Sections of the pipe, which began to perforate *on the bottom* less than two years after installation, were removed and examined. Tubercles up to about two inches in diameter were found to be present inside the pipe on the bottom. Underneath were deep pits verging on perforations. These tubercles upon chemical analysis were found to consist chiefly of ferric hydroxide associated with appreciable quantities of organic matter. The tubercles were opened while moist and gave off an obnoxious "pig-pen" odor.

This odor led us to suspect that it arose from some type of dead organism undergoing putrefaction. A bacteriological examination of the tubercles and water by an outside laboratory later showed the presence of iron-consuming bacteria of the crenothrix and leptothrix type. After careful consideration of all angles of the case, we came to the conclusion that because of the slow flow the organism formed colony "nests" on the bottom of the pipe, resulting in the formation of deposits which became oxygen concentration cells conducive to pitting. This in turn was in all likelihood accelerated by the putrefaction products of the dead organisms. Such an illustration of severe corrosion by this water (that would normally be considered non-corrosive) persuaded us to conduct studies in our laboratory where water of the same general nature was available.

Laboratory Studies

In these laboratory studies samples of scale-free iron and steel sheets (pickled) were completely immersed in flowing water contained in porcelain enameled circular containers. Fig. 1 pictures a battery of these containers.

The dissolved oxygen content of the water was adjusted and controlled at four levels, namely, 0.3 (water direct from well), 3.0, 6.0, and 9.0 p.p.m. After a relatively short period it was noted that there was a radical difference in the amount of apparent rust formation, the largest accumulation being present on the samples immersed in the water direct from the well with the least dissolved oxygen (0.3 p.p.m. O_2)—see Fig. 2. The amount decreased as the dissolved oxygen content was *increased*—see Fig. 3. In the water of low oxygen content this coating of corrosion products was decidedly fluffy and had the appearance of some form of algae, while at the high oxygen concentration the corrosion products were more dense and compact and more nearly normal in appearance.

Samples of the deposits were removed from each container and subjected to a bacteriological examination by an outside laboratory. This direct examination showed crenothrix, spirophyllum, and leptothrix (Fig. 5), while an agar culture showed the capsulated forms of cocco-bacilli (Fig. 4) to be present. In the direct examination it was found that the amount of dissolved oxygen was undoubtedly an important factor on the numbers and types of organisms present, as shown in Table I.

These results indicated that the leptothrix was the least tolerant of oxygen, the spirophyllum more so, while the crenothrix and cocco-bacilli were the most tolerant or hardiest.

During this same period the rapid failure of a pipe line in Texas occurred after about three years' service. Before the line was installed we analyzed the water, and this analysis indicated that no excessive corrosion would be anticipated, although the sulphate content of the water was fairly high. After the line began to leak a section was removed and sent to the laboratory for examination. This examination showed the inside of the pipe to carry a heavy deposit of ferrous sulphide ¼ to ½ inch thick. Although no bacteriological examination of the water was made at the time, the evidence obtained later indicated that in all probability sulphate-reducing bacteria, similar to the disulfuricans, were responsible

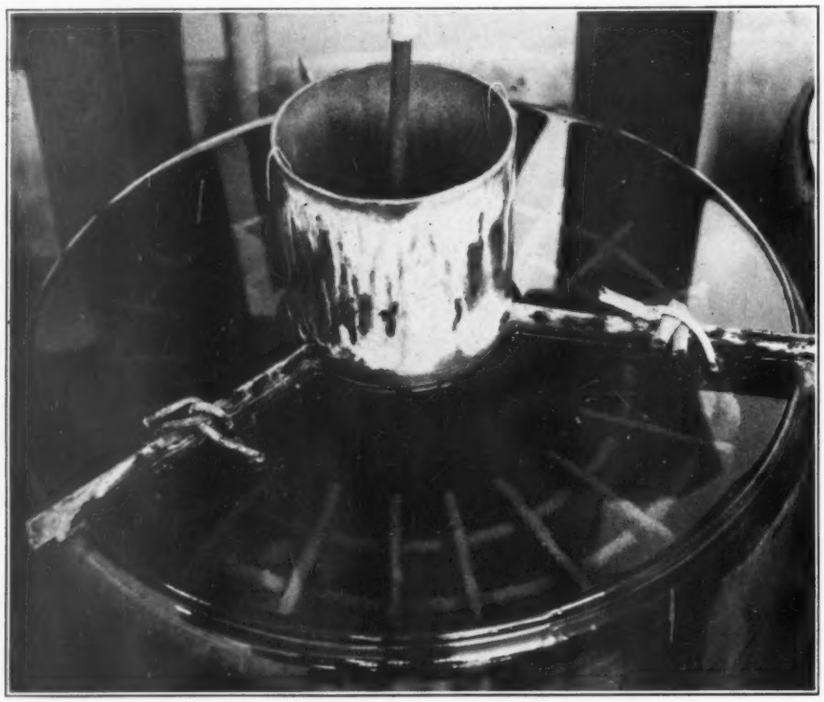
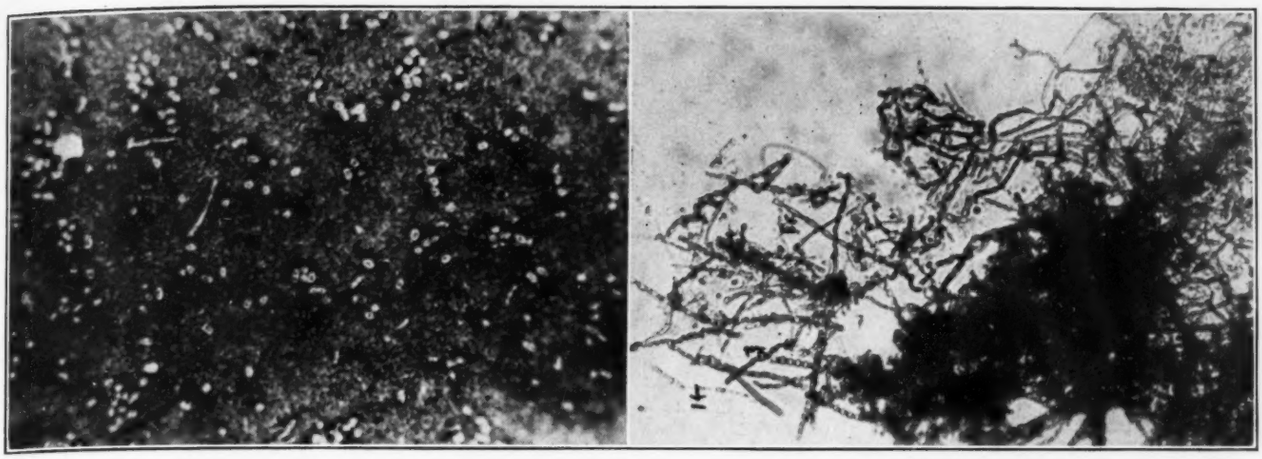


Fig. 3—The Effects of Oxygen Increase

The same water as in Fig. 2 but with 6 ppm. dissolved oxygen. The Armco studies revealed that; in general, rates of corrosion increased as the oxygen decreased—a condition experienced in dead ends and sluggish flow sections of pipe systems, especially in warm weather periods of accelerated bacterial activity.

Table I.—Organisms Predominating at Various Oxygen Concentrations.

Dissolved Oxygen	Direct Examination	Agar Culture
0.3 p.p.m.	Crenothrix, Spirophyllum, and leptothrix	Cocco-bacilli
3.0	Crenothrix, Spirophyllum, and some leptothrix	Cocco-bacilli
6.0	Crenothrix and Spirophyllum	Cocco-bacilli
9.0	Crenothrix, chiefly with some spirophyllum and a fungal form of Mycelia	Scant growth of cocco-bacilli and a moderate growth of fungus.



Organisms Predominating in Deposits Scraped from Plates in Figs. 2 and 3—See Table I

Fig. 4—Cocco-Bacilli *Fig. 5—Crenothrix, spirophyllum and leptothrix*

for the short life of the Texas pipe line.

Based on these and other experiences, it is certain that, without consideration of the biological phase in the problem, a mineral analysis and determination of the Langlier Index of the water is not enough to reasonably predict corrosion results or the service life of a pipe line. The experience with the normally non-corrosive well waters of the Miami Valley, which are very hard and contain large amounts of calcium and magnesium bicarbonates, has definitely convinced us of this fact. There is also considerable evidence in the Miami Valley wells that the deeper the wells the more chance for the presence of these organisms. In this region the water table has dwindled every year for the past ten years. In Middletown, where we are, it has been found necessary to drill deeper and deeper wells. Up to ten years ago "red-water" was virtually unknown in Middletown, even on "dead ends," but since then complaints of rusty water became so numerous that it was necessary to treat the water in order to destroy the organisms causing the trouble.

Methods of Controlling Corrosion Bacteria

There are several means by which these organisms can be frustrated in their destructive work. If an examination of the water reveals the presence of such bacteria, the municipality or industry should give serious consideration to a chemical treatment of the water at its source. Three treatments are being used in the Miami Valley, namely, chlorine, chlorine-ammonia, and lime soda. If chlorine is introduced so that the residual amount in the water is in the vicinity of 0.5 p.p.m. most of the less hardy types, such as crenothrix, leptothrix, spirophyllum, and many of the sulphate-reducing forms, such as the disulfuricans, can be destroyed. However, if it is desirable to avoid the chlorine taste in water used for drinking purposes the chlorine-ammonia or so-called chloramine treatment is recommended. This treatment is also recommended if the hardy capsulated bacteria, such as the cocco bacilli, are to be eliminated. The super-chlorination treatment may also be used.

In Middletown the city water supply is treated with chlorine-ammonia. This has eliminated red water complaints and has not affected the taste of the water. The straight chlorine treatment is used in our company's wells, and the water has a residual chlorine content between 0.5 and 1.0 p.p.m. Since treatment of our wells, there have been no stoppage of the air-conditioning coils and high pressure sprays in the mills. Poor taste of the water, and the red water trouble has been completely eliminated. Prior to this heavy chlorine treatment it was necessary to clean the air-conditioning coils in the Research Laboratories at least once a year. This treatment was the only way to get rid of accumulated growths and maintain cooling efficiency at a normal level. Expensive delays in the operating departments caused by bacterial or algae growths in high pressure sprays have been practically eliminated.

The ordinary lime-soda softening treatment apparently is satisfactory in destroying the less resistant types but does not necessarily completely eliminate the hardier types. One village in the Miami Valley treated their well supply with lime-soda; yet according to the latest information it was found necessary to supplement this treatment with chlorine.

Efficacy of Chlorine Convincingly Demonstrated

The efficacy of the chlorine treatment was demonstrated in a convincing manner during the underwater investigations conducted in our laboratory. After chlorine was introduced to the water, it was noted that the heavy growths present on the samples exposed to the lower oxygen environments began to loosen and fall from the specimens within twelve hours. In three days the entire accumulation had been removed—see Fig. 6. This in itself was a vivid and practical demonstration of the efficacy of chlorine treatment.

Besides chemical treatment of the water, accumulation of the excessive growths can be materially reduced (and in some instances probably completely eliminated) when the inner pipe walls are given a coating of a coal-tar base enamel. This greatly reduces "red water," and at the same time the pipe wall is protected against corrosion cells that spring from bacterial deposits.

Summary

To summarize briefly, we have learned that some forms of bacteria, chiefly of the anaerobic types, have much to do with the corrosion of iron and steel in natural, underwater and undersoil environments. These bacteria are not pathogenic and may be classed in two general groups, namely, sulphate-reducing and iron-consuming. Biologists have been well acquainted with their manner of living and their biologic characteristics. Their life processes, however, have only recently been associated and correlated with the corrosion of iron

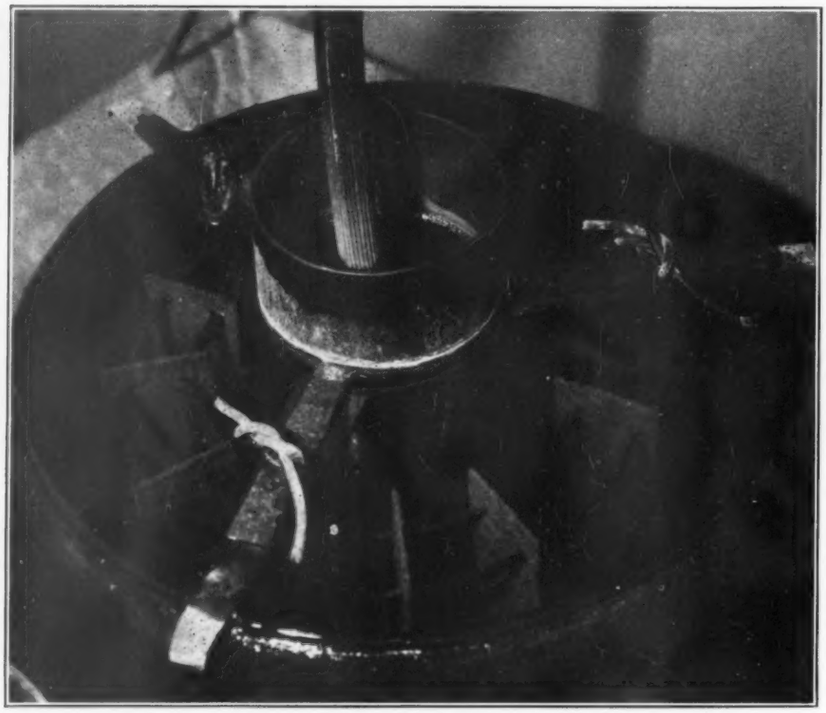


Fig. 6—A Vivid Demonstration of Chlorination Efficacy

What had been heavily infested plates. After beginning chlorination, within 12 hours the deposits began to slough off. In three days the plates were entirely freed of the accumulations, as here pictured.

and steel in underwater and soil service. Ordinary mineral analysis of water and soil has been used many times in an effort to determine their corrosivity to iron or steel, yet there are cases on record where chemical analyses indicated non-corrosive conditions and the actual service behavior was opposed to these pre-analyses. Bacteriological examinations of the water or soil and the corrosion products have brought out that certain types of bacteria contributed importantly to the severe corrosion that occurred. There are no data, to my knowledge, proving that these bacteria are directly responsible for the severe corrosive attack, but even so, their presence results in the formation of chemical compounds that either directly attack the metal or establishes conditions conducive to electrochemical attack.

When these organisms are present in water there are prescribed water treatments that will eradicate them, rendering the water inactive from a corrosion standpoint. The most common, inexpensive and simplest water treatments known today are the chlorine and the chlorine ammonia (chloroamine) treatments. These destroy the living bacteria and prevent their growth and accumulation in pipe lines and other water-handling equipment. Where untreated water is infested with these organisms, application of a good coal-tar base enamel coating to the metal is advisable.

I thank Mr. R. F. Passano, formerly of our organization, and Messrs. O. B. Ellis and D. L. Reck, members of our present corrosion section, for the contributions they have made in studying the effects of these organisms in underwater corrosion investigations carried on in our laboratory. I also thank the Wallace-Tiernan Company for their cooperation in our studies, which included the bacteriological examinations essential to the successful conduct of our investigations, both in the laboratory and in the field.

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New Jersey Sewage Assn. to Hold 4th Annual Summer Outing

America's pioneer association of sewage works operators for the past three years has held a well attended Summer Outing annually. This year the 4th Outing is to be held at Doerr's Grove, Livingston (Essex Co.), N. J., all day, Saturday, Sept. 26th. An innovation is the invitation to the ladies to attend, in view of restricted vacation travel this year which has kept many member's wives at home all summer.

This meeting is devoted solely to frolicking and no business. The printed menu and arrangement of games between the "Peddlers and Politicians" sound amply interesting.

Word has been received that the New Jersey Ass'n. which last March voted to join the Federation of Sewage Works Associations is now offically a member Association with all privileges.

In charge of the Livingston Outing is Henry Van der Vliet, Supt. of Public Wks., Maywood, N. J., and president of the Association.

WATER SUPPLY AND SEWERAGE UNDER SINGLE MANAGEMENT

Some Comments and Opinions After Thirty Years of Joint Operation

By HAROLD L. BRIGHAM*
Superintendent
WATER AND SEWER COMMISSION
MARLBOROUGH, MASS.

WATER services and sewer services in the same trench are well known to be bad practice, but water works and sewerage systems under the same management for the small or medium sized city—why not?

Before discussing such a problem, a short resumé of the historical background of these services in our city may be of interest in arriving at our conclusion of "Why Not?"

The public water supply in this city was inaugurated, after several previous attempts, in 1883, and the town was fortunate in securing the services of a very able man, the late George A. Stacy, as superintendent of the works. Under his management the water works of Marlborough expanded rapidly and in 1888, when it was decided to have a public sewer system, the logical person in the town to supervise the construction of such works was the water works superintendent, he being the person most familiar with trench work through the streets of the town. After the completion of the system it was turned over to the Highway Department to operate, but this management was not particularly satisfactory. In 1912 it became necessary to enlarge and remodel the sewage treatment works. Again Mr. Stacy was called upon to supervise the work. This time the State Legislature was petitioned for the authority to set up a Water and Sewage Commission in Marlborough that would have charge of both systems. This was done in 1912.

Under this Commission the operation and maintenance of both systems progressed satisfactorily with the exception of the collection of the sewer rentals, which were being collected by the Tax Collector.

In 1923, when water rates and sewer rentals became a lien on property by act of the Massachusetts Legislature, the billing and collecting of sewer rents, based on meter readings, was turned over to the Water Registrar.

A single bill is now rendered by the Registrar for all water and sewer charges and they are collected by the Registrar and turned over to the City Treasurer.

The Author
President-elect, N.E.W.W.A.

Some Advantages of Joint Operation and Management

After nearly twenty years we find this quite a satisfactory way of operating. The same office force and the same maintenance crew are used for both divisions, which eliminates duplication of forces. Of course, many of the same type of tools and equipment are used in both divisions and here also a duplication of equipment is eliminated.

Certain sections of the sewer system that are not in the gravity section have to be pumped and the geographical layout of the city is such that these sections can be pumped by pumps and power from one of the water works pumping stations loacted in the westerly section of the city

Our water supply reservoirs consist of one natural lake and one made reservoir having a total watershed of about 2,400 acres and a total storage of about 600 million gallons

The sewage treatment works are located in the extreme easterly section of the city and consists of plain sedimentation tanks and about twenty acres of natural sand filter area that has been shaped into percolating beds with a system of underdrainage discharging into a brook at the edge of the plant.

We find that we avoid duplication of many things by having a combined Water and Sewer Commission. For instance, when flushing water mains, they are discharged into the sewer system which avoids separate flushing of the sewer; also that a large increase of sewage flow observed at the treatment plant will usually indicate a leak in the water system that is finding its way into the sewer system.

The same trucks, tools, equipment and men are used in both divisions, and all service connections, both water and sewer, are made by the Commission using the same service crew.

All construction of mains, both water and sewer, are done by our regular forces supplemented by extra temporary laborers as required.

For a city of 15,000 people our manufacturing load for water is not very heavy, our average pumping being about one million gallons per day, increasing somewhat in very warm weather. The average flow at the sewage treatment plant is also about one million gallons per day, varying from a low of 500,000 gallons per day to 2,600,000 gallons per day, some of which is due to infiltration in the older parts of the collection system that is in swampy territory, and is tile pipe with cement joints.

We take the water from nature, deliver it to our customers to use. After use, they return it to us and we process it and return it to nature in a condition approaching that when we received it.

Disadvantages?

There may be some disadvantages in operation of these two essential public services under the same management, but after more than thirty years' experience in such dual operation, we are of the opinion that any such disadvantages are more than offset by the advantages.

From a sanitary and public health standpoint, both of these services are closely related and are more easily handled by a single management, therefore Water Works and Sewerage under a single management, "Why Not?"

*The author has the distinction of being the President-elect of the New England Water Works Association.

MODERN STOREYARD AND GARAGE FACILITIES

Proves Decided Adjunct to the Water Works System of Akron

By WENDELL R. LA DUE
Superintendent and Chief Engineer
DIVISION OF WATER AND SEWERAGE
AKRON, OHIO

THE Division of Water Supply of the City of Akron has recently completed an extensive improvement to its storeyard. The work was done as a W. P. A. project at a cost of $37,750 to the City of Akron and at an expenditure of $71,560 by the W. P. A. involving 1,100 man months of work.

In 1912 the city acquired the privately owned Akron Water Works Company. Included in the purchase was a considerable area about the pumping station on Wooster Avenue which served as a storeyard. This yard was entirely inadequate, being poorly located and without railroad facilities.

With the completion of the purification plant and pumping station at Kent, Ohio, in 1915 and the consequent abandonment of the Wooster Avenue pumping station, the value that the storeyard had by reason of its proximity to the other water works activities disappeared and a more suitable site was sought.

In 1919 a six-acre parcel of land located at the northeast corner of Johnston and South Streets was purchased for this purpose. It is much more centrally located and has a frontage of about 800 feet on the Akron-Barberton Belt Railroad.

The Author

In 1920 the storeyard was graded and a double switch track was run in from the railroad. A space in the front of the yard facing Johnston Street was reserved for the future construction of a garage and repair shop; however, it was not until 1925 that a 228 by 156-foot building was constructed housing a 75 car-storage garage, automobile repair shop, storeroom and meter repair shop. Upon its completion, all service and maintenance operations were transferred to this location.

The purchase of additional property in 1924 and 1929 added 1.84 acres to the site.

During the period 1927 to 1939 various improvements were made by the water works employees, C. W. A., F. E. R. A., and W. P. A. work agencies. These consisted chiefly of the construction of concrete crib retaining walls along the drives and along the east property line (made necessary by the topography), the grading and cindering of the drives, general grading about the yard, and the construction of railroad rail supports for cast-iron pipe storage.

Plans Made to Complete the Development

Drawing on the experience of this twelve-year period of construction and operation of the yard, plans were drawn in 1939 to complete the development of the property. Certain areas amounting to 1.8 acres leased to the Street Repair and Sewer Divisions were not included in these plans other than making them accessible to the main yard, leaving the detailed development to their respective divisions.

The garage and storeyard of the Bureau of Water Supply occupy the remaining 6 acres. As the accompanying pictures reveal, about 60 per cent of this area is impervious, being composed of paved driveways, paved storage areas, and roofs. The runoff is therefore practically instantaneous. Storm sewers had to be de-

Akron's New Storeyard

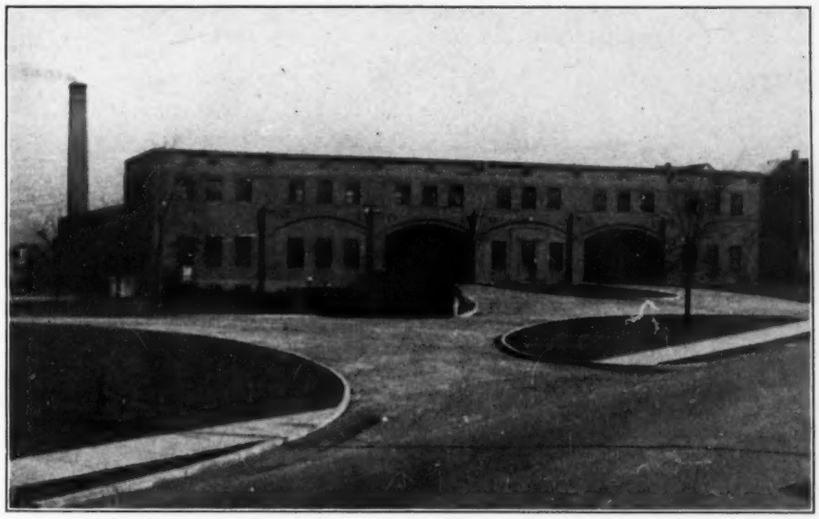
Viewed from the Roof of the New Garage, the Front of Which Is Shown in Another Picture. Note the Three Level Construction, with Retaining Wall and Protective Fence Beyond on Right.

signed to provide adequate drainage for the entire yard, using an impervious coefficient of .80 for the whole area. A combined sewer crossing the southwest corner of the property provided a convenient outlet.

Entrance to the garage and storeyard is made from Johnston Street over either of three new driveways. One is to entrance and exit doors of the garage, one to the ramp to the basement, and one to the receiving platform at the side of the garage, and then continuing to the rear of the garage and to the storeyard. (See view of entrance drives.) A fourth exit and entrance is to be found at the rear of the yard, by a driveway opening on Hedden Avenue.

Prior to the work on this project, the drives at the entrance and through the storage yard were surfaced with cinders. Little or no attention had been paid to drainage and consequently severe rutting occurred following heavy rains.

Partially to correct this evil and for the sake of the general improvement, it was decided to pave all driveways in the yard. All drives with the exception of those about the front entrance were constructed of 8-inch concrete, 17½ feet in width and reinforced with No. 4 wire mesh. Three-fourths inch round rods were used to reinforce the edges of the slabs. The entrance drives were similarly constructed with the exception that their minimum width was



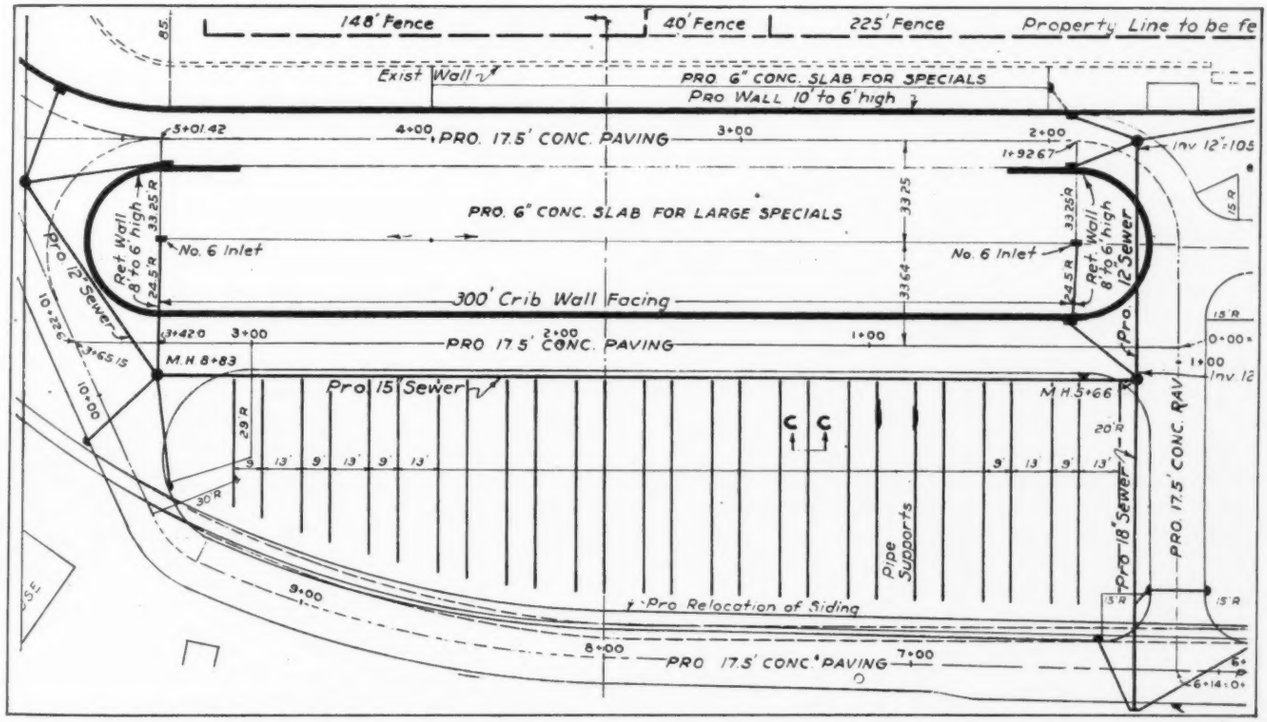
The Garage, Meter Repair Shop and Stores Building from Johnston St.

20 feet. Expansion joints were placed at 50-foot intervals.

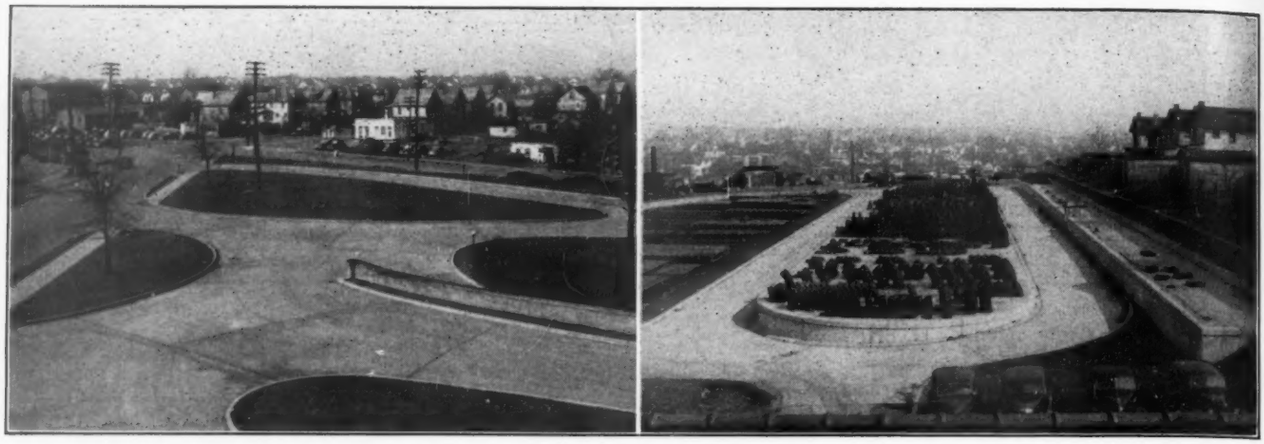
Johnston Street is a fairly heavily traveled cross town thoroughfare, particularly during the early morning and later afternoon hours. It is during these hours also that the in and out traffic from the garage is at its maximum. Approximately 300 vehicles make use of the entrance drives during this time. To relieve the congestion, the north side of the existing 30-foot pavement was widened 5 feet for the full length of the block in which the garage is located. The Division of Highways contemplates a further widening of 5 feet on the opposite side of the street, which will increase the pavement width to 40 feet.

Three Level Construction Adopted to Increase Usable Area

The storeyard had previously been graded to two levels, the lower level being used for pipe storage and the upper level for the storage of special castings and lumber. Much of the upper level was useless for storage purposes, however, because of the necessary sloping banks. In order to utilize the entire area, it was de-



General Plan of the Yard.
The Garage Is to the Right.



Three Way Entrance from the Street, and a Closer View of Upper Levels Where Castings and Fittings Are Stored at Truck Bed Height.

cided to regrade the yard to three levels or steps, making the change from one elevation to the next approximately 4 feet.

This work involved the excavation and hauling from the site of 20,000 cubic yards of earth. Approximately one-half of this was excavated by hand labor and removed in 3-ton trucks. A one-half cubic yard power shovel excavated the remainder and a fleet of four 8 cubic yard hauling units removed this from the site.

The regrading of this area increased the available area for storage of special castings about 50 per cent, making the total area now about 21,000 square feet.

To add to the ordinary difficulties encountered during such excavation, it was necessary to move 640 tons of cast-iron pipe and special castings from two to three times before the project was completed.

Truck Bed Height Chosen For Each Rise in Level

The 4-foot difference in elevation between levels, previously mentioned, was adopted as being the average height of a truck bed, and since a concrete drive is located adjacent to each step, the loading and unloading of heavy castings is greatly simplified.

This area was paved with concrete 6 inches in thickness and reinforced with No. 4 wire mesh of the same design and in the same manner followed in the pavement construction.

It is intended that castings stored here be placed in rows at right angles to the drives, leaving 4-foot aisles between them (see cuts). An ordinary two-wheeled freight truck is to be used to move the castings on and off the trucks.

Cast-Iron Pipe Storage

A permanent type of support for cast-iron pipe was designed for pipe storage. It consisted of 12-inch wall, 3 feet 2 inches in height, on a 10-inch footing, 2 feet in width, running at right angles to the railroad siding and driveways. An 80-pound railroad rail was mounted on the top of each support.

These supports, alternately spaced at 9 and 13 feet apart, provide storage for either (or both) 12 or 18-foot lengths of pipe.

It is intended that pipe be stored by placing them lengthwise across two pipe supports, bells at the same end, and separating the layers with 4 by 4-inch timbers to facilitate the rolling of the pipe.

The area provided will care for the storage of 2,400 tons of pipe of various sizes stacked ten pipe high on the supports.

Movement of C. I. Pipe And Castings

The following is a table showing the movement of cast-iron pipe and special castings in the yard for the years of 1940 and 1941:

	C. I. Pipe Tons	Special Castings Tons
Used 1940	428	43
Inventory Jan., 1941	437	205
Used 1941	533	45

Note that only about 20 per cent of the available pipe storage is generally in use. The manufacturer supplying cast-iron pipe is located conveniently for truck delivery and up to the present time delivery could be obtained on reasonably short notice.

The storage of special castings is another matter. Sufficient fittings must always be available for emergency use at all times, and since this emergency use cannot be predicted, approximately five times the average yearly use is maintained in storage.

The railroad siding on the west side of the pipe storage provides for rail delivery and the center drive on the east side takes care of the truck delivery, as well as the loading for delivery to the various jobs in progress.

Protection Fence

The entire storage yard, with the exception of the north property line, is protected by an 84-inch protection fence. During the construction of this project an additional ten acres have been acquired, abutting this north line, for future extension. Fence for this area has been ordered and will be erected upon delivery.

General

Work was started on the project by the W. P. A. on January 16, 1941, and completed November 21, 1941, using an average of 85 men five days per week.

All material with the exception of 3,000 barrels of cement was furnished by the Bureau of Water Supply now the Division of Water and Sewerage.

Following are the principal items of construction material used in the work:

Cement	5,950 bbl.
Sand	2,870 tons
Slag	2,810 tons
Reinforcing steel	18 tons
Reinforcing mesh	25 tons
Expansion joint material	1,800 sq. ft.
Railroad rails	260 only
Railroad tie plates	200 only
Brick (sewer)	21,000 only
Vit. sewer pipe (10 in. to 21 in.)	1,860 lin. ft.
Inlet castings	21 only
Manhole frames and covers	7 each
Bituminous filler	27 drums
Black-top pavement	150 tons
Form lumber	3,000 ft. B.M.
Trench sheeting	13,000 ft. B.M.
Protection fence	1,050 lin. ft.

Equipment used:

Air compressor	1
Concrete paving mixer	1
Concrete mixer 10-S	1
Truck—three ton	4
Bulldozer and rooter	1
½ cu. yd. power shovel	1
8 cu. yd. hauling units	4

Plans are now being prepared for the development of the 10 acre addition to the storage yard. Plans and specifications have already been completed for the construction thereon of a two-level garage containing 63,760 square feet of floor space. At present, however, War Production Board regulations have stopped construction work of this kind for the duration.

It is intended that such garage and storage space not required at the present by the Bureau be leased to other city departments, with allocation of space to best suit the needs of the several activities involved, namely, water supply distribution and service, street repair, street cleaning, sewer maintenance and parks.

The above described work was under the direct supervision of the author as Superintendent and Chief Engineer of the Division of Water Supply and Sewerage, assisted in the field work by A. E. Goodman, Associate Engineer, the city's representative on the work, and L. W. Bausher, Junior Engineer. Mr. Earl Howard was the W. P. A. Field Supervisor.

A SODA-ASH FEED PROBLEM

And a Solution That Proved Very Simple

Contributed by
EDWARD A. DYER
Sup't. of Water
COBLESKILL, N. Y.

PERHAPS some of the readers of WATER WORKS AND SEWERAGE may have experienced the same problem as we have finally solved at Cobleskill—namely, the problem of gradual choking of soda-ash feed lines with encrustation, and the need for frequent and bothersome cleaning of 40 feet of ¾-inch feed line. We offer our experience in hope that it may help some other plant operator experiencing the same or a similar problem.

By making some very simple changes in our Soda-Ash solution feed line we have been able to reduce to a very great extent the building up of deposits on the inside of the pipe.

Our original set-up to feed Soda Ash consisted of a four hundred gallon capacity storage vat into which the soda was dissolved daily. From this the solution was carried by gravity through about thirty feet of three-quarter-inch pipe to a box into which the solution dropped. The solution stream entering the box was controlled by a three-quarter gate valve.

A float valve connected to a filtered water line was installed to discharge in the box to provide make-up water for a two-inch piston pump operating at a constant speed. The pump discharge of soda solution diluted by make-up water was carried through about forty feet of three-quarter-inch pipe to a tap in the filtered water main.

About once a month, and usually at the most inopportune time of day, it was necessary to dismantle the line from the constant level box to the point of application, including the pump with its valves, piston and packing, to dig or ram out the deposits that had accumulated. Often it was found that the opening in the pipe had closed off to a hole about the size of a hay wire and that the pump valves were so heavily coated that they had become inoperative.

This bothersome condition had been put up with for about four years when we suddenly realized that the solution line from the storage vat to the constant level box had never given any trouble and that the flow therefrom was as strong as the day it was installed. It was decided that the dilution of the soda solution with filtered water in the constant level box was responsible for the trouble. By cutting a three-quarter inch pipe into the discharge of the chemical feed pump and running it back to the float in the constant level box, thereby using the same soda solution as make-up for the pump rather than filtered water, we have had no trouble from plugging of the feed line or pump in the past seven months.

[Had lime been employed instead of soda-ash the rapidity of feed line blockage would have been even more rapid from the addition of "make-up" water containing calcium bicarbonate. Therefore the Cobleskill method of solving the problem applies to lime or caustic soda feed as well as to soda-ash.—Editor.]

Recent Army Appointments

The following readers of WATER WORKS AND SEWERAGE have recently been commissioned Captains in the Sanitary Corps, U.S.A.:

B. A. Poole, former Chief Sanitary Engr. of the Indiana State Dept. of Health. Acting as Chief for the duration is Joseph L. Quinn, Jr. As noted in our August issue, Captain Poole was recently elected to the Board of Control of the Sewage Works Federation and was recipient of a Geo. W. Fuller Memorial Award at the A.W.W.A. Wartime Conference, Chicago.

H. H. Gerstein, former Sanitary Engineer in charge of the Water Safety Control Section in Chicago, Bureau of Engineering. Appointed Acting Chief for the duration is T. Schmid. Mr. Gerstein has just retired as Chairman of the Illinois Section of A.W.W.A. and received the Hill Cup for the greatest membership gain of any A.W.W.A. Section during the year. Capt. Gerstein is for the present in the 22nd Medical Battalion, Camp Grant, Ill.

W. W. Watkins, former Sup't of Water Works and Sewerage at Oneonta, N. Y., to which position he expects to return after the "scrap" is over. "Bill" Watkins has a background of four years of military training at the Virginia Polytechnic Institute. He is temporarily located at Carlisle Barracks, Pa.

[Note: If other readers will also let us know when they enter any branch of the service we shall be happy to have this information for future issues.—L. N. E.]

PRIORITIES CLINIC

To Be Feature of Sewage Conference

Technical Program Built on Wartime Considerations

PREPARATIONS for the Wartime Conference on Sanitation, to be staged by the Federation of Sewage Works Associations at the Hotel Statler, Cleveland, Ohio, October 22-24, are nearing completion by the Convention Management Committee and the local arrangements groups.

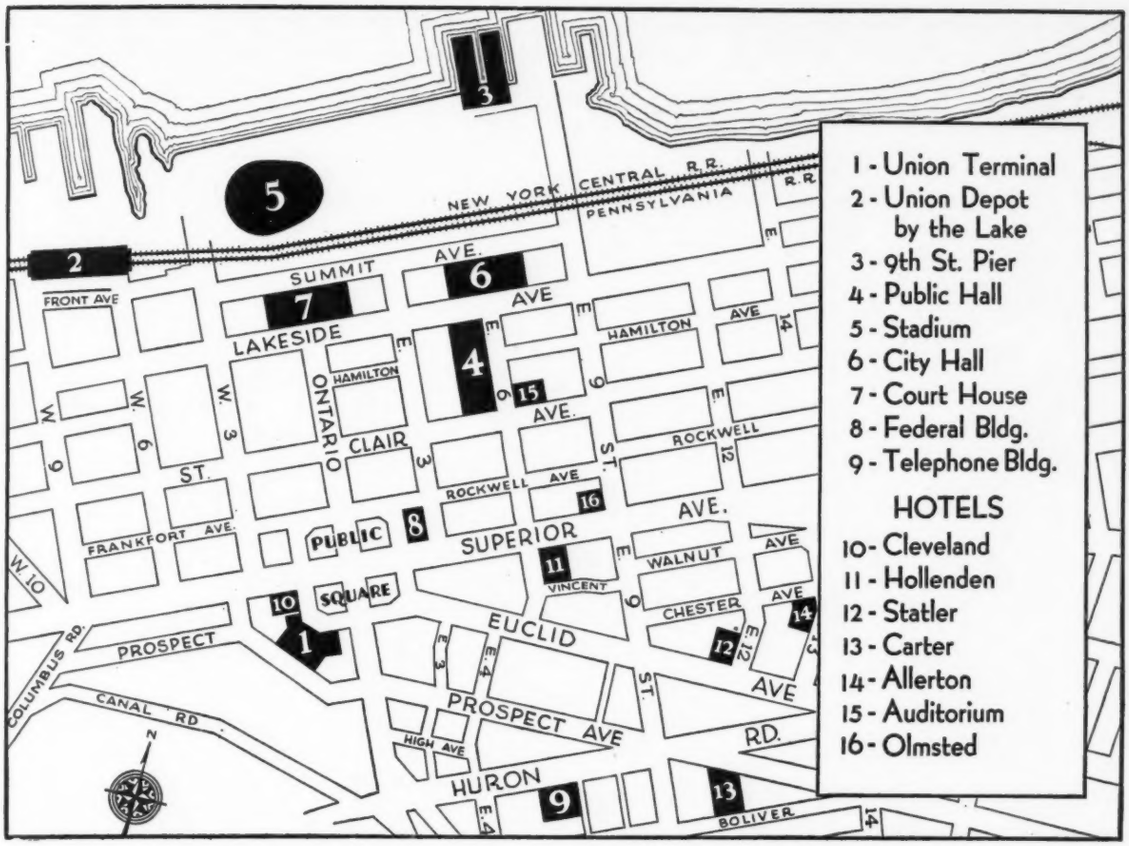
This meeting should be a "must" for engineers and sewage works managers at a time when equipment shortages, materials priorities and wartime operation problems are imposing new operating conditions on thousands of sewage and waste treatment works in the United States. The third annual meeting of the Federation is specifically aimed at the solution of wartime emergency problems.

Priorities Clinic

One of the most important considerations for those who can arrange to attend this Conference on Wartime Sewage Works Problems will be the Priorities Clinic being arranged for. Patterned after the very successful and beneficial A.W.W.A. Conference on Wartime Water Works Problems held in Chicago, the Priorities Clinic is being featured. If for no other reason, sewage works engineers and managers can justify the trip to Cleveland in order to learn of the newest developments in the priorities situation as these affect sewage works maintenance and operation. Those who bring questions to the Clinic will have them answered by men most familiar with the priorities situation, interpretations, rulings, methods of procedure in securing required ratings and equipment and materials. Such questions as what equipment, materials, repair and replacement parts come under the A-2 priority rating; the A-5; the A-1-C recently granted for urgent replacements and repairs—i.e., anticipated replacements of vital parts before actual breakdown occurs.

The Clinic will be conducted throughout the conference under the direction of Federation Secretary Wisely and L. E. Rhein, Chairman of the Executive Committee of the Sewage Works Division in the W. and S. Works Manufacturers Association. Other authorities will also be on hand to give advice and guidance in the matter of procurement of equipment and materials on the critical list; the inventory requirements; how to keep ahead on maintenance and repair requirements without accumulating inventories in excess of the allowable limits specified by the W.P.B.—in short how to keep going and how to keep out of trouble with the Washington authorities that have been amply considerate in prescrib-

Map Revealing the Central Location of Cleveland



Map of Downtown Cleveland, Showing Hotel Locations

ing ratings for water supply and sewage utilities.

Yes, the Priorities Clinics in Cleveland, October 22-24, will alone be worth the price of admission.

Equipment Exhibits to Feature Maintenance And Conservation

The Exhibits Committee, under the chairmanship of Arthur T. Clark, Sec'y and Manager of the Manufacturers Association, has announced that the convention will feature an equipment show which will have unusual significance in war-times. Leading manufacturers of equipment and supplies will exhibit their products and give advice to municipal authorities on the care and conservation of existing equipment and materials stocks.

Technical Program Also Features Wartime Considerations

The entire technical program, prepared under the guidance of F. W. Gilcreas will have a wartime character.

We regret that the completed program has not yet been released by the Program Committee and can not be printed in this issue. However here are some advance tips on "who's who" on the program.

A. M. Rawn (Los Angeles) and H. G. Baity (Univ. of North Caroline) will discuss the impact of war on sewage treatment problems. L. H. Kessler (Utilities Branch, U. S. Quartermaster Corps) and Guy Griffin (U. S. Engineers) will present data on the operation of sewage treatment plants in military cantonments. L. F. Warrick (Madison, Wis.) will analyze wartime sanitary problems of a State Health Department. W. A. Stinchcomb (Cleveland, Ohio) will discuss civilian defense problems.

Operators will engage in a symposium on plant maintenance in war-time, led by C. C. Larson of Springfield, Ill. The technical sessions will feature war problems.

The sewage treatment system of the City of Cleveland will be inspected by the Convention. Entertainment for members and guests is being planned, commensurate with wartime transportation and other restrictions. W. L. Havens, Chairman of the Convention Management Committee, has announced that the Convention will be a fitting sequel to the Chicago and New York meetings. The Committee has announced that J. V. N. Dorr, President of the Dorr Co. and eminent scientist, will be the featured luncheon speaker.

The Federation will meet in Cleveland under the joint sponsorship of the Ohio Conference on Sewage Treatment, and all committees have representatives of both the Federation and the Conference. Those in attendance from other state associations will have the opportunity for state reunions and will compete for the reunion cup awarded to the group traveling the greatest number of man-miles to the Convention. The veteran operators of the Quarter Century Club will again be honored at the meeting.

Conference Ideally Located and Timed

It is evident from the accompanying map that Cleveland is an ideal location for the Wartime Conference. Note the densely populated territory within a radius of 400 miles of Cleveland, permitting economical transportation. The meeting is ideally timed to meet the restrictions on travel. One trip will permit members to attend the meeting of the Federation, and to participate in the sessions of the American Public Works Association, to be held in the same hotel during the four days prior to the Federation Conference.

MAINTAINING OPEN DIFFUSER PLATES WITH CHLORINE

Experiences of Two Years at Jackson, Michigan

By R. B. JACKSON
Plant Engineer
SEWAGE TREATMENT WORKS
JACKSON, MICH.

THE Jackson activated sludge plant was placed in complete operation May, 1937. The city is served by combined sewers and the plant treats an average flow of 7 m.g.d. There are four aeration tanks, each 240 ft. long, 25½ ft. wide, and 16½ ft. deep with 1½ foot freeboard. There is a center wall which extends 128 ft. from the influent end of the tanks, making two passes of sewage through each tank. The diffuser plates are in the bottom, a single row on each side in the first bay to the end of the center wall, then a single row down the center of the second bay to the effluent end. These tanks have been operated on the tapered aeration principle—that is, the maximum amount of air has been put in at the influent end and progressively lesser amounts of air have been added toward the effluent end. The blower equipment at Jackson consists of two 4,500 cu. ft., three-stage, single-flow centrifugal blowers, driven by 250 H.P. 440 volt motors through speed increasing gears, and one 3,000 cu. ft. blower of the same type driven by a 150 H.P. motor.

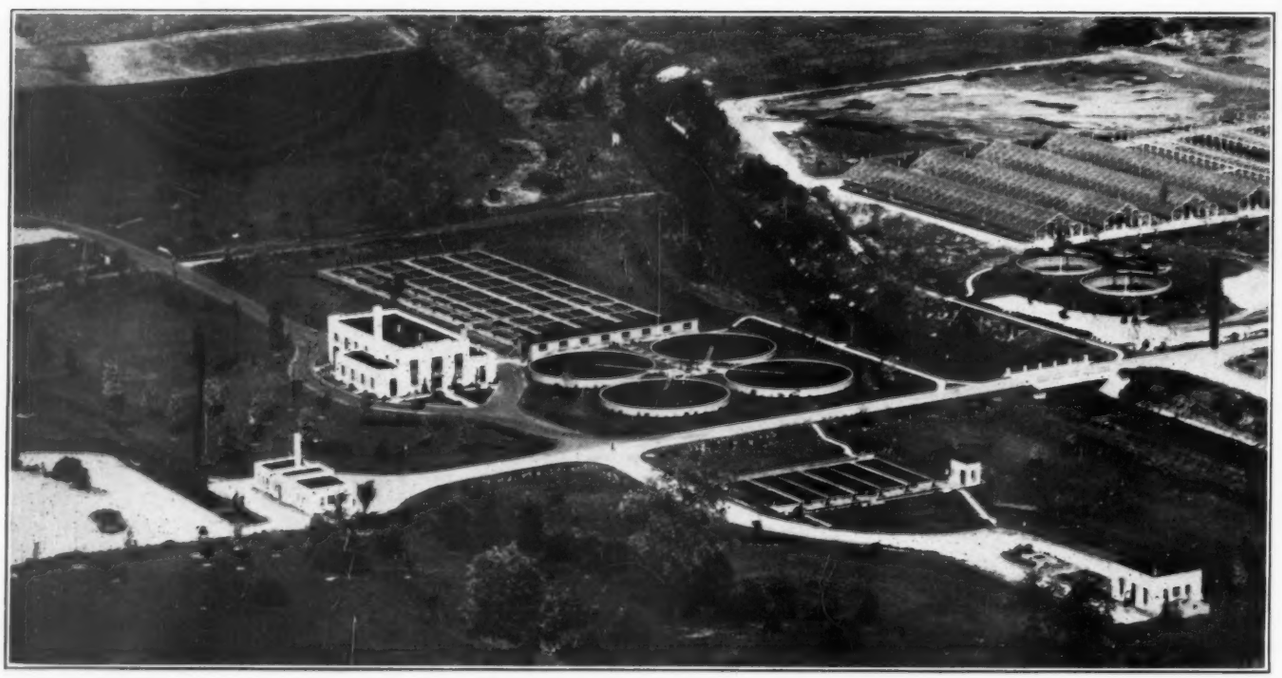
The Author

Plate Clogging and Relief Measures

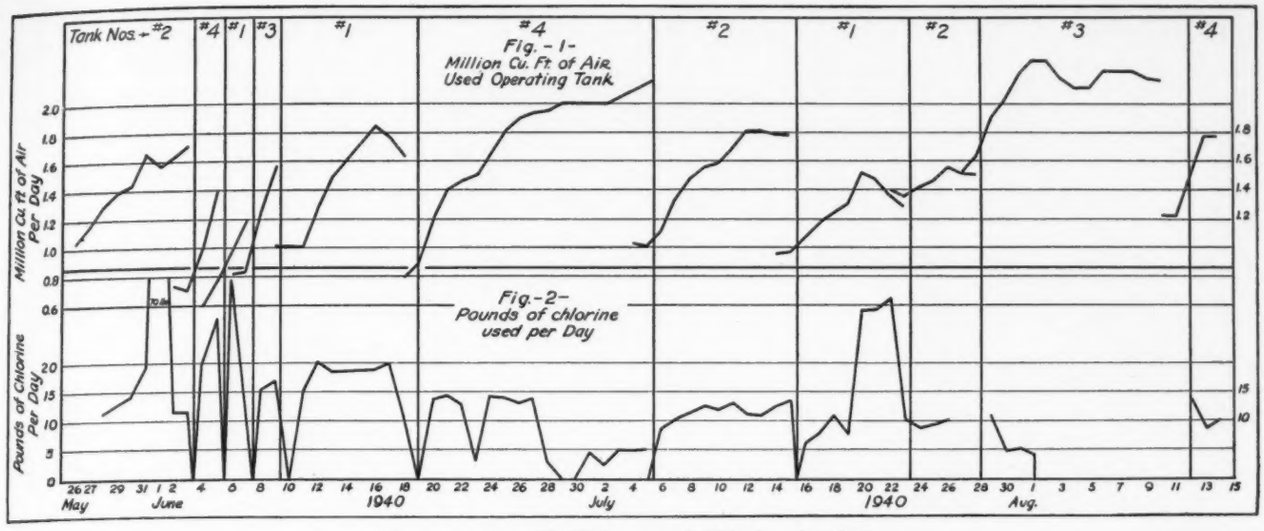
After three years of operation, we began to notice that the air to the aeration tanks was dropping off and we could not blow out the plates by increasing the air input and raising the pressure. Our superintendent, A. B. Cameron, then decided to add chlorine to the air supply going to the aeration tanks. A cylinder of chlorine was placed on a platform scale and the amount of chlorine gas added to the air header direct was determined by the decreasing weight of the chlorine and container. At first, chlorine was added to each tank for two days until all of the tanks had been treated, then it was added to each individual tank for a period of a week or more, until the volume of air going into the treated tank no longer showed air increasing rate from day to day. This treatment was started on May 28, 1940.

Ratio of Chlorine Gas to Air Input and Effects

The graph presented as Fig. 1 shows the amount of air that each aeration tank received per day and the graph presented as Fig. 2 reveals the amount of chlorine added from day to day.



General View of the Jackson (Mich.) Plant
(Photo by Abrams Aerial Surveys, Lansing, Mich.)


Tank Nos. → #2 #4 #1 #3 #1 #4 #2 #1 #2 #3 #4
Fig. - 1 -
Million Cu. Ft. of Air Used Operating Tank
Million Cu. ft. of Air per Day
Fig. - 2 -
Pounds of chlorine used per Day
Pounds of Chlorine per Day
May June 1940 July 1940 Aug.

Figs. 1 and 2—Air Volume and Chlorine Applied

(Note the progressive climb of air input resulting from the injection of chlorine gas into the air header at rates indicated. No changes in blower operation were made throughout the periods indicated, the increase being due to the increasing plate porosity resulting from chlorine application.)

Some of the history is as follows: On June 4th, 20 pounds of chlorine was added to Tank No. 4. Without any other changes the air input increased from 700,000 cu. ft. to 1,000,000 cu. ft. in one day. On June 5th, 27 pounds was added and the air flow increased to 1,400,000 cu. ft.—or twice as much as before the "chlorine purge" was begun. Fine, but by June 18th (13 days thereafter) the air input to Tank No. 4 had dropped to 800,000 cu. ft., or approximately the amount before the chlorine was added. We went back to Tank No. 4, and this time chlorine was added until July 5th, or seventeen days. At no time was the rate more than 15 pounds per day. During this period the air increased to 2,160,000 cu. ft. per day —more than triple the 700,000 cu. ft. By Aug. 10th (35 days later) the air had dropped back to 1,200,000 cu. ft. per day, then chlorine was added for three days and the air increased to 1,760,000 cu. ft. See Figs. 1 and 2. The rest of the tanks performed in very much the same manner when chlorine was added to the air. The history of each is revealed in Figs. 1 and 2, showing the chlorine rates, duration of purges, and air input build-up.

While chlorine was being added to the tanks, the 3,000 cu. ft. blower was being used. At the start, the blower was discharging at the rate of 4,000,000 cu. ft. of air per day, and at the end the discharge was approximately 5,500,000 cu. ft. The power consumption increased from 2,450 to 2,770 kilowatt-hours per day or an increase power cost of about $3.00 per day. However, the point of importance was the fact that the kilowatt-hours per million cu. ft. of air decreased from 600 to 520. Graphs presented as Figs. 3, 4 and 5 show the air and power for each day while the chlorine was added.

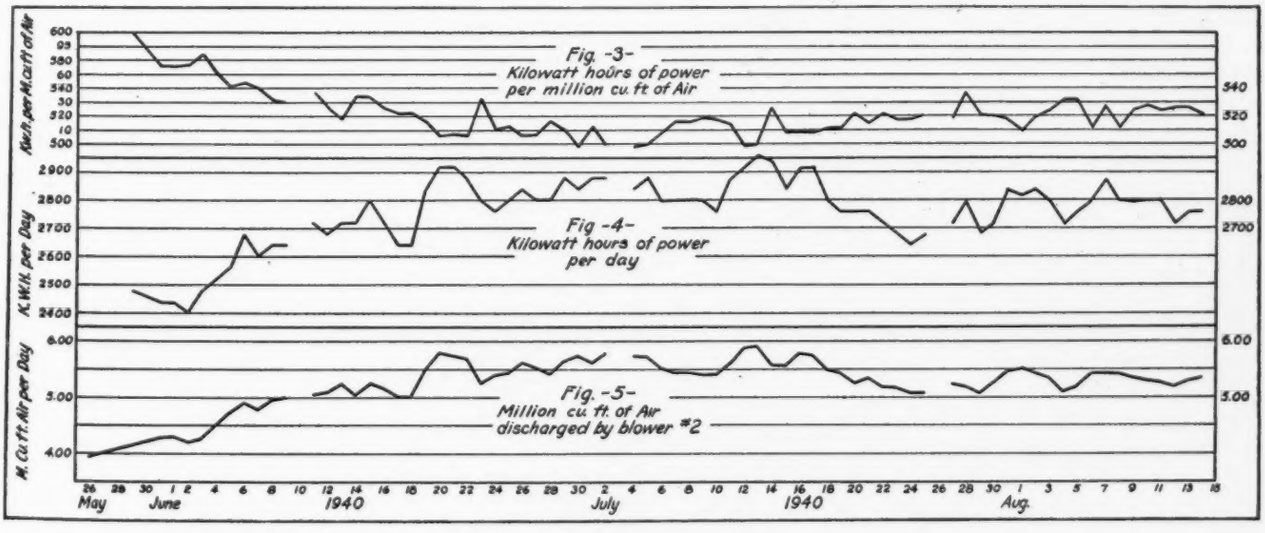
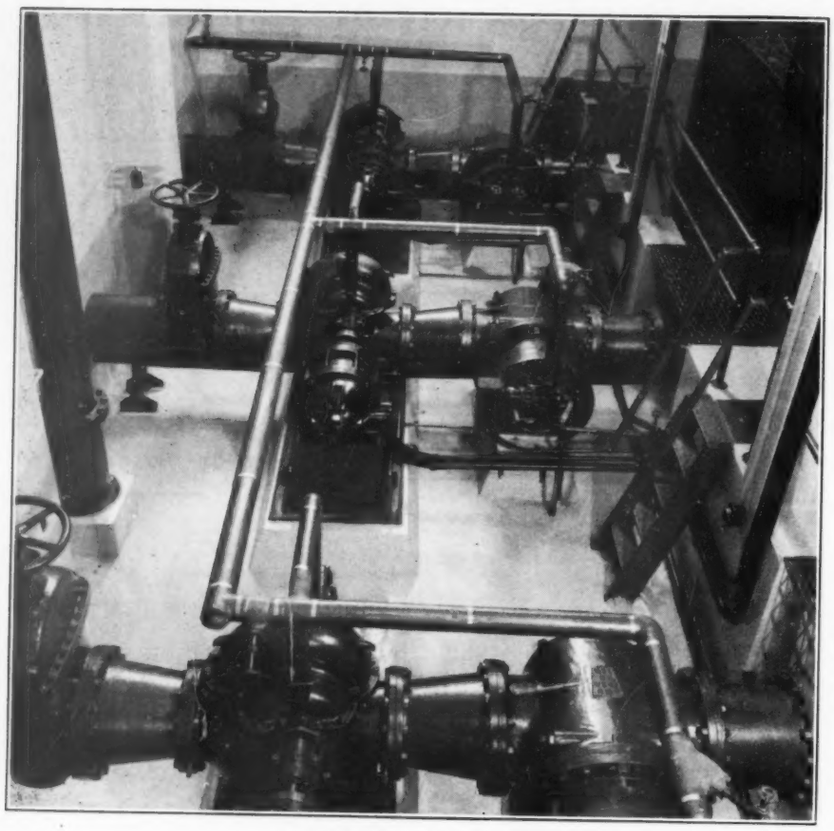


Fig. -3-
Kilowatt hours of power per million cu. ft of Air
Kwh. per M. Cu. ft of Air
Fig. -4-
Kilowatt hours of power per day
K.W.H. per Day
Fig. -5-
Million cu. ft. of Air discharged by blower #2
M. Cu. ft. Air per Day
May June 1940 July 1940 Aug.

Figs. 3, 4 and 5—Ratio of Power Consumption to Air Volume

(Note—As to be expected, the freer plates, permitting greater volume of air output of blowers, resulted in increased power consumption. However, the air volume per k.w.h. was greater, and, therefore, the cost per million cu. ft. became less as the result of chlorine treatment. See text for cost data.)



Jackson Pumping Station
(*American Pumps and Smith Plug Type "Rotovalves"*)

Routine Practice Established

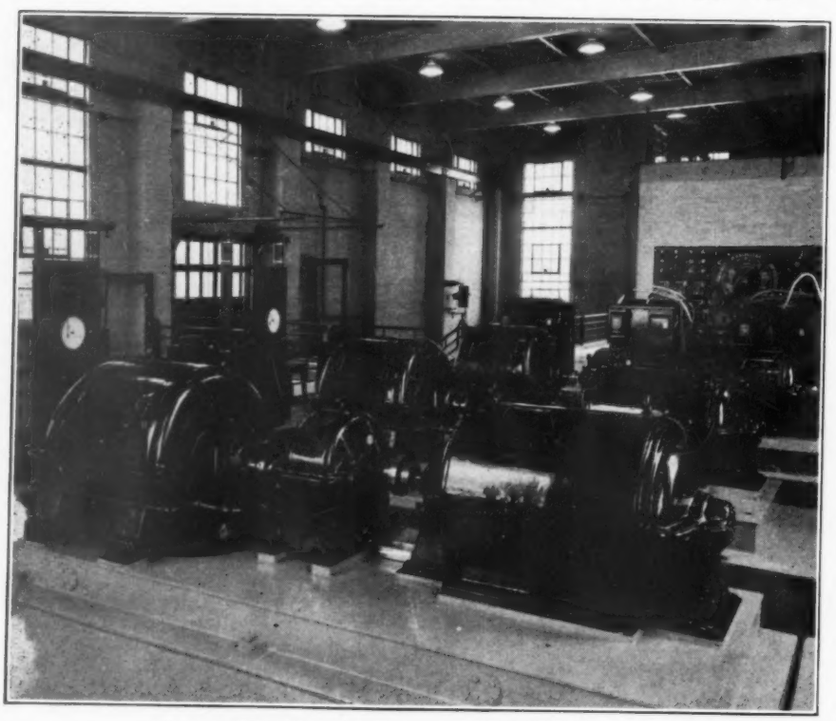
Since Aug. 15, 1940, we have added chlorine to the air as soon as the rate of air input to a tank begins to fall off. We have found that if chlorine is added at the rate of about 4 pounds per hour for two or three hours, we secure the maximum benefit per dollar of cost. Last February we found that when we added chlorine it would not increase the air to the tank. In consequence, it was decided to give all of the plates an acid bath, which has now been completed.

Our routine in the future will be to use chlorine at intervals, so long as it will clean the plates as indicated by increased air flow into a tank. When the clogging has reached a status wherein chlorine does little good, then to take the plates out and give them an acid bath.

No Ill Effects Noted

We did not notice any ill effects to our pipe system as the results of the injection of the chlorine gas, and feel that this method of application will not affect the piping when chlorine is used in the dilution indicated in the accompanying graphs.

The simplicity and economy of the method constitutes an important point in favor of this scheme of relieving plate clogging, resorting to more drastic and expensive methods of rehabilitation only when necessity dictates.



The Blower Room—Jackson, Mich.

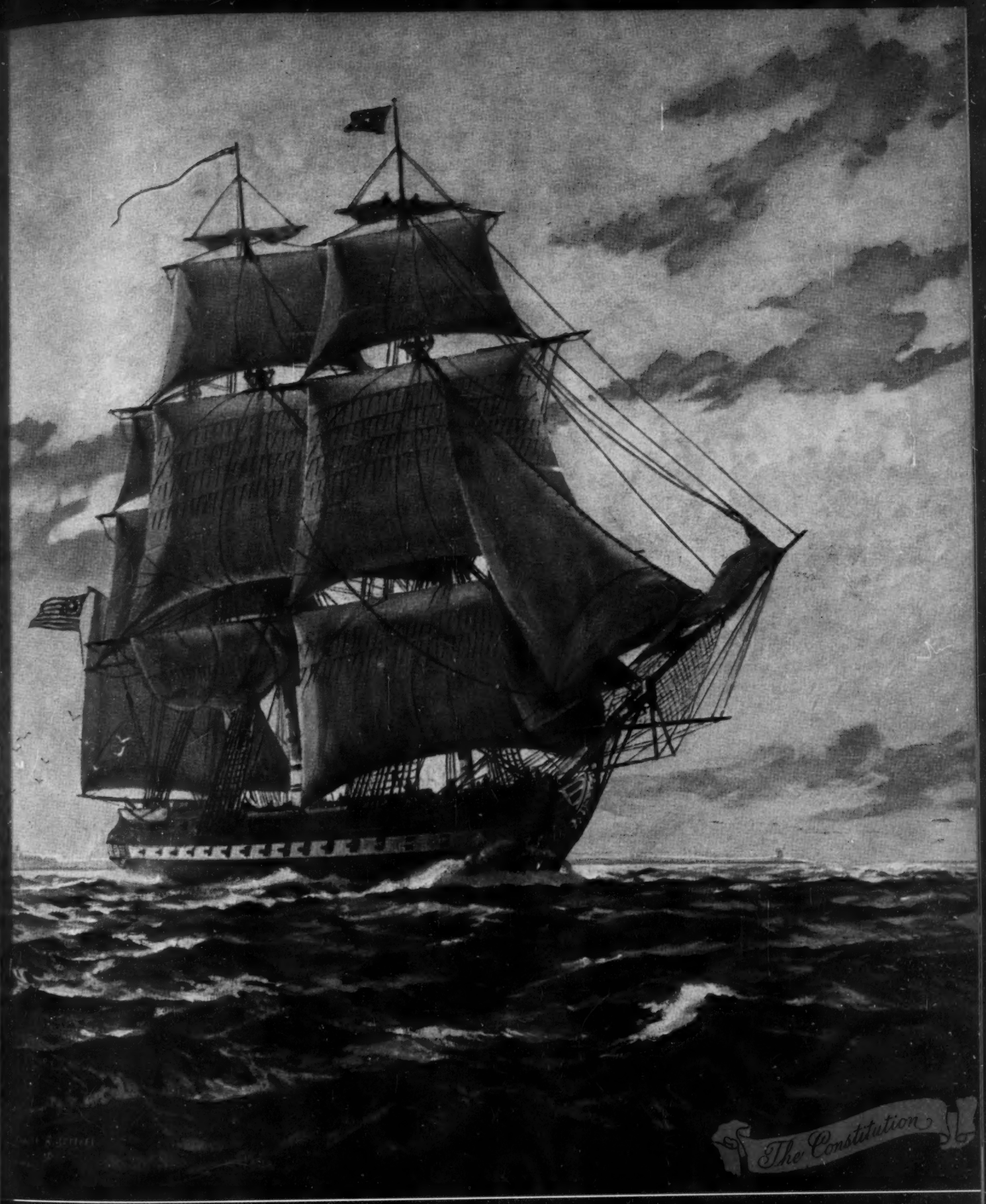
One Way to Save Rubber and Also Get Better Results

Rubber has been and still is commonly used as a gasket material, but now that it is becoming so scarce the writer suggests that gasket users begin looking for suitable substitutes.

There are of course places where rubber cannot be supplanted easily. But for large pipe flanges, manholes, tube caps, and the like, there are gaskets on the market that the writer regards as *better* than rubber. Thus, for example, thick flexible metallic gaskets are excellent for withstanding high pressures. They are exceptionally strong and considerably thicker than the ordinary rubber gasket. As a result of this thickness they will take care of flanges that are slightly irregular more effectively than will thin rubber gaskets.

Also, metallic gaskets are more easily and economically replaced than are rubber gaskets that "stick." The writer has in mind a job where the time required to replace rubber gaskets was four times as great as the time required to replace thick metallic gaskets. Why? Because the metal gaskets didn't stick at all whereas the rubber gaskets stuck and were removed with great difficulty. Further, due to their thickness and strength, the metallic gaskets did a much better sealing job than did the rubber.

*A timely suggestion from W. F. Schaphorst, M.E., Newark, N. J.

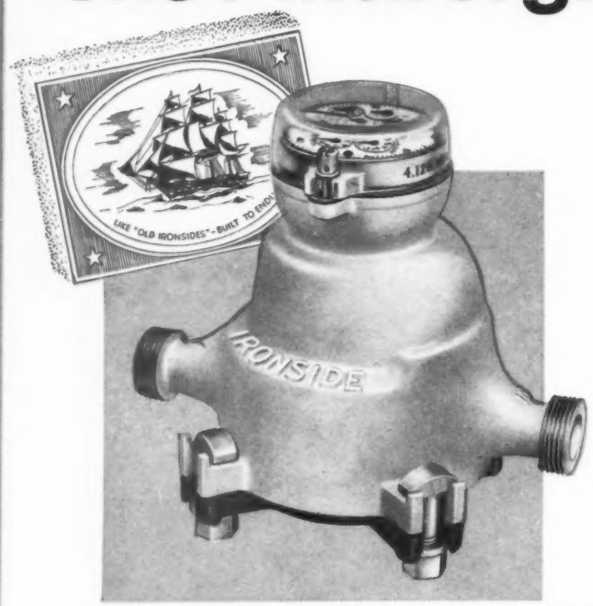


Like "Old Ironsides" . . .

Pittsburgh-National Water Meters are Built to Endure

Pittsburgh-National Water Meters are Built to Endure

The Pittsburgh IRONSIDE Meter



The Ironside is a top quality disc meter in the construction of which over 70% of the bronze normally used in meters of this size has been eliminated.

Rust-proof cast iron and molded glass have been ingeniously substituted for bronze in the outer shell, register box and register lid. This redesign has been effected without sacrificing any of the quality construction features that have for over fifty years been associated with the Pittsburgh name.

The vital inner working mechanism, time-tested and proven in thousands of Pittsburgh Arctic and Tropic Meters, requires only a small quantity of critical material. Special care has been devoted to protecting the cast iron surfaces from rust and corrosion.

In every way, the Pittsburgh Ironside Meter has been designed to provide the best in disc meter measurement value. Like "Old Ironsides" from which it is named, this meter will give unfailingly dependable service both during the emergency and for many years to come.

THE NEW MOLDED GLASS REGISTER BOX

This Pittsburgh-National development is a single piece, strong molded glass unit which fits snugly over the register and is retained against a fibre gasket. It serves both as register box and lid; protects the register against dust and moisture; and will withstand considerable abuse

The Empire VICTORY Meter

For 72 years Empire Meters have held an unexcelled record for accuracy, long life and low cost of maintenance. The Empire Victory Meter has been designed to perpetuate this enviable reputation. It is a fully protected iron case, oscillating piston meter, in the construction of which about 70% of the bronze normally used in a meter of this size has been eliminated.

The time-tested oscillating piston principle of measurement, using the famous Empire Balanced Piston, provides unexcelled accuracy. Smooth flow lines and interior contours, in combination with a measuring chamber having dual inlet and outlet ports, keeps pressure absorption at the absolute minimum. The design incorporates many innovations in construction that reduce friction and wear, assuring retention of the high initial accuracy of the meter over a long period of time.

Empire Victory Meters are a sound investment in measurement. They provide, in full, all the benefits of metering without costly losses, resulting from inaccuracy, premature wear or mechanical failure.

PITTSBURGH-NATIONAL METERS

THE MOST COMPLETE LINE OF WATER METERS IN THE WORLD

PITTSBURGH EQUITABLE METER COMPANY

NEW YORK · BROOKLYN · DES MOINES · OAKLAND · TULSA · CHICAGO

MERCO NORDSTROM VALVE COMPANY
Main Offices, Pittsburgh, Pa.
NATIONAL METER DIVISION, Brooklyn, N. Y.

KANSAS CITY · PHILADELPHIA · SAN FRANCISCO · LOS ANGELES · SEATTLE · HOUSTON · COLUMBIA · BUFFALO

"WHASSAMATTER WITH THE WATER" QUERIES FEWER

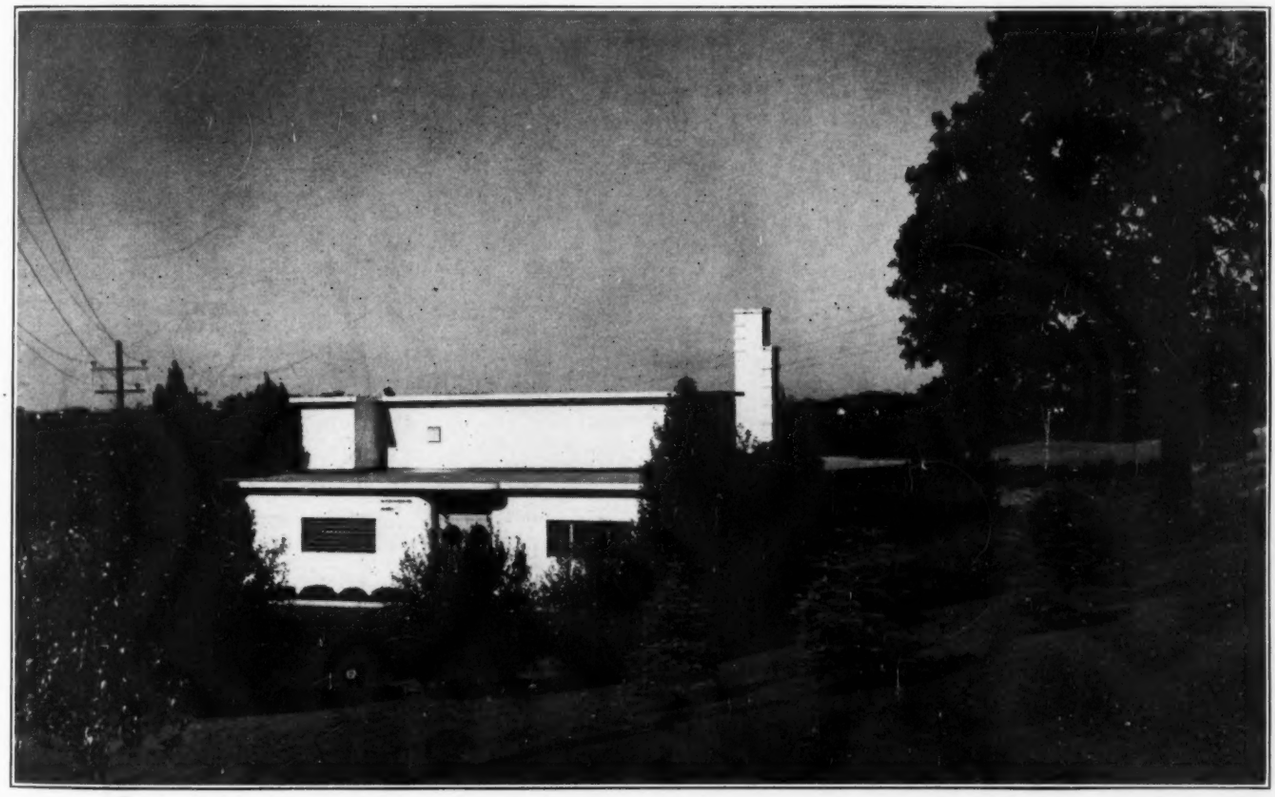
A Story of Rates, Records, Modern Water Treatment, Metering and Commission Management in a Small City

By JOSEPH E. YOUNG
Superintendent-Engineer
WATER AND LIGHT DEPARTMENT
FERGUS FALLS, MINN.

THEORETICALLY speaking, absence of main line and consumer metering, maps, records, proper bookkeeping, and modern billing procedure could reduce overhead expense and, in turn, the total expense of operating a water department. The operating experience, however, of the Water Department of the City of Fergus Falls, Minn. (population 10,848), shows evidence, it is believed, that such controls are not only of practical benefit but that the information gained from records properly carried out and interpreted can be made to yield returns which are many times greater than the extra expense and effort involved.

The Author

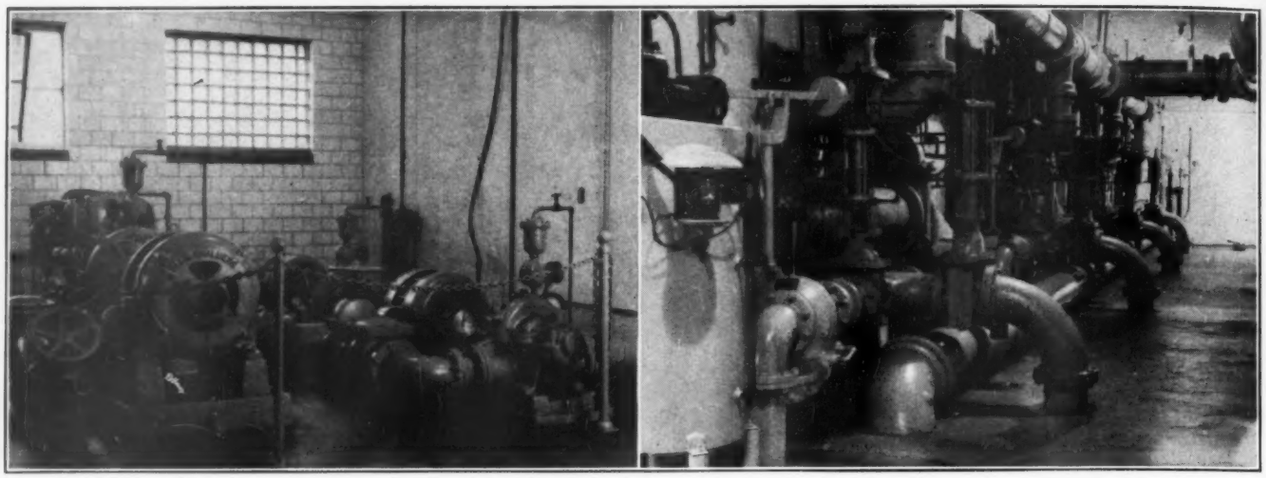
In the larger utilities, many of the operating methods and record keeping are in the hands of specialists. On many occasions, in accordance with well-known laws of human behavior, it happens that the specialists, urged by a conviction of the importance of their particular work, carry it out in such detail and in such a manner that bunches of red tape are evolved which cause expenses out of proportion to the useful results obtained. Oftentimes, persons connected with smaller utilities have been convinced that operating methods would be improved and operating expenses lowered if proper systems of records were available. Then, upon investigation they have been discouraged from setting up such records because the methods of specialists have convinced them that extra expense would be incurred which would not be justified by the savings and the better service which would result.



The Fergus Falls Filtration and Softening Plant

A combination of attractive setting and utilitarian service. And an example of the adaptation of economical architectural concrete construction.

WATER WORKS & SEWERAGE, September, 1942



Pumping Equipment and Pipe Gallery, Fergus Falls, Minn.

The Fergus Falls System in 1929

Up until the year 1929 the operating conditions, facilities, service, and records of the Water Department of the City of Fergus Falls were probably among the most simple that existed in any utility of comparative size. Water production facilities consisted of a small pump house located at the edge of a surface reservoir, which had been created to impound water used for water power. The equipment in this pump house consisted of one centrifugal pump of obsolete model and another one which was more modern and performed most of the pumping; this pump, however, was operating for a long period of time with but one-half of a bearing at the end of the shaft. There was also provided chlorinating equipment, but this was in such a condition that it worked at intervals only. The water from the surface reservoir was pumped directly into a main which led both to the city and to a concrete reservoir on an adjoining hill. When this reservoir became full, or as happened oftentimes, overflowed, the pump was stopped by a watchman. Through gravity feed this reservoir supplied the distribution system of the city.

Complaints Not Unjustified

The water obtained from the surface reservoir had characteristics which averaged approximately as follows: hardness, 220 p.p.m.; color, 10 p.p.m.; average threshold odor, 10 p.p.m.; B coli index, 2 per 100 cc. These characteristics, of course, although good for a raw, untreated water, fell far short of modern standards for water to be furnished through a public distribution system.

Although regular water consumers became accustomed to the characteristic swamp tastes and odors, such tastes and odors were found decidedly objectionable by the casual user. Moreover, these tastes and odors, for several months of nearly every year, became so pronounced that even many of the regular consumers queried, "Whassamatter with the water?" Their general opinion was that it was due to chlorine, although the facts were that chlorine was used only at intervals and the intervals did not coincide at all times with the prevalence of objectionable tastes and odors. It was natural that because of the peculiar tastes and odors, the water was questioned from the standpoint of its healthfulness. The sanitary quality of the supply, judged by the low coli index, however, was generally good. Only on occasion did the coli index rise above what was considered safe values. Because of the absence of filtration, it followed that mud and small animal life also found their way into the mains and distribution system, and, of course, such conditions were also objectionable. When consumers queried as to the water quality, attempts were made at first to explain the tastes and odors by telling the story of the way of life of a fellow named "Algy" and his relatives. When it became apparent that this explanation did not give much solace to the consumer, a different approach was tried. When the glint in the consumer's eye indicated to the employee that the approaching consumer was to make the oft heard inquiry, the scheme was evolved of beating him to the punch by making the same inquiry first, "Whassamatter with the water?" This seemed to secure better results as it classed the employee as a fellow sufferer with the consumer. When an employee, however, told a woman who complained about bloodsuckers in her faucet, "There's no extra charge, lady," results from a public relations standpoint were not so good.

Records, Rates and The Balance Sheet

The records of money were kept on a receipts and disbursements system. Although the treasurer's reports showed that the disbursements kept pace with the receipts, the rate charged for water was comparatively high. The existing rate consisted of a flat charge annually, based on the number of fixtures, payable in advance, plus a charge of 10 cents per 1,000 gallons. The average cost to the consumer with a modern home, when sprinkling was not required, was $1.25 per month. This relatively high rate was also a cause of consumer complaint. At the end of the fiscal year April 1, 1928, customers of the department totaled 1,440 and the total income was $30,100. The plant had been purchased from a private utility in 1907 for approximately $90,000, and the outstanding bonds in 1928 totaled $99,000. The cash fund was overdrawn by $1,785 and the surplus values above outstanding debts were approximately $165,000.

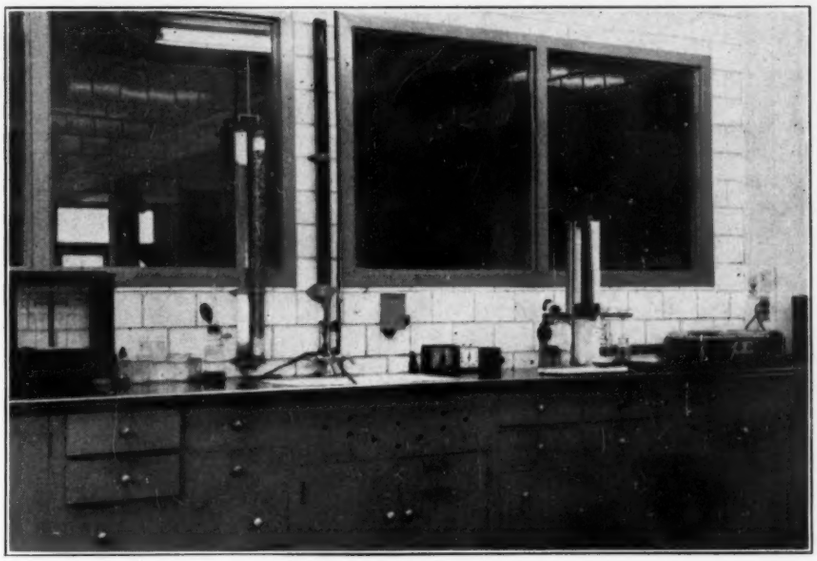
Metering and Modern Billing Show Results

During the fiscal year ending in 1929 a start was made toward the completion of metering, modern billing procedure and the obtaining and

recording of pertinent information that would be useful in operating the plant. Better results were noticeable within a few months. The revenue, with very small increase in customers, increased from $30,100 to $35,111 at the end of the fiscal year 1929 and continued to increase at a comparatively rapid rate until the end of the fiscal year 1931, when it stood at $39,931 with 1,520 customers buying water. Apparently during the two years preceding 1931 expenses were decreased, for comparatively large amounts of money became available not only for the purchase of additions to the plant but for the purchase of needed physical betterments such as an automatic chlorine machine which would chlorinate the water in a dependable manner at all times.

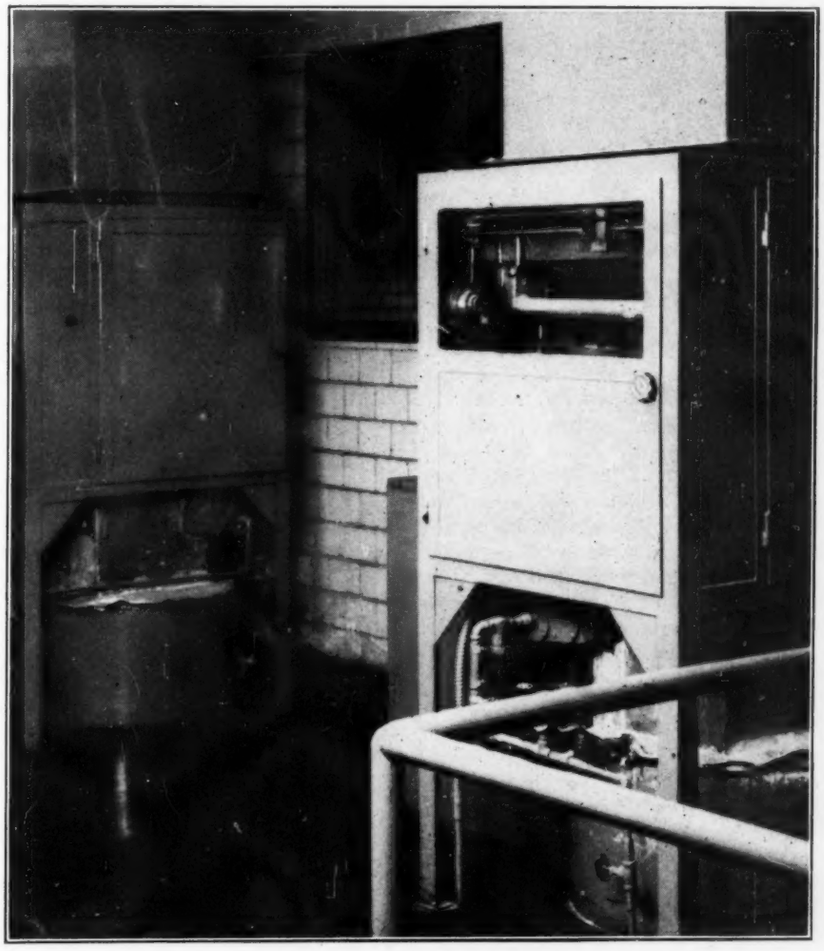
The physical evaluation of all assets of the department made possible the establishment of a system of accounts as of April 1, 1931, based upon those recommended by the National Committee of Railway and Utilities Commissions. The first balance sheet produced under the new methods showed a larger operating profit than our Water and Light Commission thought necessary. Accordingly, a new schedule of water rates, which afforded a very substantial decrease in charges, was placed in effect. The new schedule followed A. W. W. A. recommendations and consisted of a flat charge, based on the size of the meter, which in this particular instance was 50c per month for a ⅝-inch meter, and 10c per 1,000 gallons of water metered. The new rates afforded a reduction of nearly 50 per cent in cost to the larger share of residential consumers and a substantial reduction to nearly all other consumers. Furthermore, rates for installing and repairing services were reduced as much as 50 per cent. These reductions in rates were well received by the consumers and the effect of the reduction was, seemingly, to lessen criticism of the quality of the water. Although the revenue was reduced to approximately the 1928 levels and customers had increased about 5 per cent, money became available, because of reduced operating expenses, for the payment of the bonds and the improvement of the plant. The Fire Underwriters recognized the value of the augmented and improved plant by increasing their rating of the system from 7 to 5.

Operation of the plant continued at the lowered rates, bond payments were made, and the system was improved with money from the reduced income until 1937, when outstanding bonds had been reduced from $99,000 to $27,000 and the available surplus value of the plant had risen to $322,957.



The Laboratory, Fergus Falls, Minn.

In this partial view of the laboratory is seen the carbon filter for producing odor-free dilution water and our Enslow continuous stability indicator of twin-tube design.



Lime Feeders at Fergus Falls

These machines feed pulverized unslaked lime direct without the conventional slakers.

A New Treatment Plant Voted

Meanwhile, experiments which had been carried on since 1930 with activated carbon had convinced the Water and Light Commission that the reasons for the query, "Whassamatter with the water?" could be largely eliminated if proper facilities were available. On their recommendations, a bond issue of $80,000 was passed, the proceeds of which were to provide funds for the installation of a modern purification plant with water softening facilities. Combining of the water purification and water softening facilities was made because the Commission had been convinced through investigation that not only would softened water be very desirable to use, but that savings to consumers would result, which in themselves would equal nearly the entire added operating expense of the project.

The plant, which was designed and largely constructed by department employees, was placed in operation January 1, 1939, and has made possible the bettering of the estimates of the results which would be obtained. With the advent of the purified water produced by the plant, the principal characteristics of which are as follows: 56 p.p.m. hardness; zero turbidity; 26 threshold odor; and color approaching zero; and zero B coli index, querulous complaints as to the quality of the water also dropped to nearly zero. On occasion even compliments concerning the quality of the water distributed were and are received. As expected, the operating expenses of the department were necessarily increased about 125 per cent over the 1931 cost. The operating statements available showed, however, that while the number of customers had increased 26 per cent over the year 1931, the total revenue for the new purified water was considerably less than that received in the year 1931 from the smaller number of customers. Despite these facts, money was still available to take care of reasonable depreciation and a reasonable increase in facilities.

A copy of the operating statement of the department and a balance sheet such as is produced every month to present operating data, is shown herewith for April 1, 1942, which is the end of the department's latest fiscal year. Below this balance sheet and operating statement is given comparative data as to plant statistics.

Examination of the figures shown in the tabulations will reveal the comparatively large increase in customers and facilities and the amount of the added purification expense which was not provided for in 1931 when rates were reduced. The total income at the end of 1942 is about 10 per cent more than the average income during the years 1931 to 1942, and is about 10 per cent more than the income found available at the end of the fiscal year 1928, when changes in methods were introduced.

Comparative Statement of Income and Expense

(Fergus Falls Water Department)

	March 31, 1941	Feb. 28, 1942	March 31, 1942
Gross Revenue:			
Water Sales:			
Residential—water metered	$ 8,131.51	$ 7,020.27	$ 7,502.03
Commercial—metered sales	6,493.36	6,331.90	6,455.94
Residential—flat charges	9,456.60	9,018.78	9,820.92
Commercial—flat charges	2,444.73	2,191.54	2,377.96
Wholesale sales	3,710.76	3,303.42	3,604.92
Municipal hydrants	3,000.00	2,750.00	3,000.00
Total water sales	$33,236.96	$30,615.91	$32,761.77
Merchandise sales and jobbing	569.52	158.56	145.82
Penalties collected	172.79	148.52	148.52
Miscellaneous operating revenues	114.00	136.37	133.80
Gross revenues	$34,093.27	$31,059.36	$33,189.91
Operating Expenses:			
Production: Power for pumping	$ 1,428.23	$ 1,270.79	$ 1,378.27
Purification:			
Superintendence and labor	3,260.80	3,013.85	3,422.50
Heat, light and power	1,005.49	784.81	1,010.84
Supplies and expense	5,622.28	5,182.79	6,088.16
	$ 9,888.57	$ 8,981.45	$10,521.50
Distribution:			
Superintendence	$ 900.00	$ 787.50	$ 900.00
Inspecting and testing meters	1,048.20	720.50	804.23
Other distribution operating labor	505.29	190.51	190.51
Supplies and expense	31.28	151.17	168.15
Maintenance of dist. bldgs. and equipment	297.80	365.91	340.35
Maintenance of mains	536.78	811.37	979.30
Maintenance of services	1,267.78	302.49	568.61
Maintenance of hydrants	174.71	123.72	144.99
	$ 4,761.84	$ 3,453.17	$ 4,096.14
Meter reading, billing, and collecting	$ 1,037.84	$ 706.11	$ 1,011.36
Administrative and General:			
Administrative salaries	$ 1,620.00	$ 1,417.50	$ 1,620.00
General office salaries	300.00	273.80	311.30
Office supplies and postage	196.56	189.93	196.23
Insurance	225.99	15.00	240.98
Truck expense	465.27	452.89	528.35
Other general expense	331.28	285.57	335.88
	$ 3,139.10	$ 2,634.69	$ 3,232.74
Depreciation	$ 6,815.28	$ 6,247.34	$ 6,885.04
Total operating expenses	$27,070.86	$23,293.55	$27,125.05
Net profit from operations	$ 7,022.41	$ 7,765.81	$ 6,064.86
Other income:			
Assessments for mains	$ 2,253.95	$ 188.00	$ 188.00
Miscellaneous non-operating income	84.00	21.00	265.36
Sewage disposal expense allowance	360.00	300.00	360.00
Collections on accounts charged off	2.84	4.55	4.55
Total other income	$ 2,700.79	$ 513.55	$ 817.91
	$ 9,723.20	$ 8,279.36	$ 6,882.77
Other Deductions:			
Interest on bonded indebtedness	$ 2,472.46	$ 5,282.50	$ 3,382.95
Legal service—filter bond issue	.....	.....	125.25
Accounts charged off	5.93	.....	74.07
Net profit	$ 7,244.81	$ 2,996.86	$ 3,300.50

Comparative Statement of Assets and Liabilities

(Fergus Falls Water Department)

ASSETS—	1942	1941
Currents Assets:		
Cash:		
Contingent fund	$ 90.00	$ 90.00
Cash in banks	4,612.66	16,431.54
Sinking fund—cash	245.47	.....
Customers' deposit fund	2,127.47	2,096.47
Accounts Receivable:		
Water bills for month of March	2,147.56	2,112.88
Delinquent accounts—customers	488.46	597.12
Water main assessments	582.50	582.50
Inventories:		
Materials and supplies	19,194.55	8,284.36
Total current assets	$ 29,488.67	$ 30,194.87
Permanent Assets:		
Appraised or cost values	$496,527.66	$490,545.52
Less: Depreciation reserves	90,617.42	83,732.35
Net permanent assets	$405,910.24	$406,813.17
Total assets	$435,398.91	$437,008.04
LIABILITIES—		
Current Liabilities:		
Accrued current expenses	$ 1,569.62	$ 1,595.04
Customers' deposits (contra)	2,127.47	2,096.47
Water main assessments assumed by water department	100.00	340.68
Total current liabilities	$ 3,797.09	$ 4,032.19
Bonded Indebtedness:		
Water works	$ 10,000.00	$ 10,000.00
Filtration plant and system	77,000.00	80,000.00
Total bonded indebtedness	$ 87,000.00	$ 90,000.00
Total liabilities	$ 90,797.09	$ 94,032.19
SURPLUS—		
Excess of Assets Over Liabilities:		
Balance—beginning of year	$342,975.85	$335,731.04
Add: Net profit for year	3,112.50	4,990.86
Assessments for water mains	188.00	2,253.95
Net premium on bonds issued	245.47	.....
	$346,521.82	$342,975.85
Deduct: Premium on bonds called	1,920.00	.....
Balance—end of year	$344,601.82	$342,975.85
Total liabilities and surplus	$435,398.91	$437,008.04

Fergus Falls Water Department Statistics

	Fiscal Year Ending April 1, 1942	April 1, 1931
Customers	1,945	1,500
Mains 16 in. to 4 in.	144,168	107,700
Mains replaced	13,000	.....
Gate valves	202	168
Hydrants	153	107
Hydrant rental	$3,000	$5,400
M. gallons sold retail	139,704*	139,160
Retail sales	$26,156.85	$30,322.00
M. gallons sold wholesale	60,083	73,320
Wholesale sales	$3,604.92	$4,020.00
Total revenue, water main assessments, hydrant rental, and water sold	$33,742.46	$39,931.00

*Water sales off, due to imposition of commercial sewerage tax and favorable rains, about $1,600.

Although the querulous complaints regarding water and rates have been reduced to a very small number because of the change in rates and the improvement in the quality of the water, there is evidence to believe that further application of the methods described will reduce costs. For example, the unaccounted for water at the present time is running about 14 per cent of the total supplied to the city. Methods of locating and repairing leaks which have been developed by department employees have reduced the unaccounted for water to this comparatively low figure from a percentage that ran for many years in excess of 50 per cent. There is every evidence to believe that continuance of the methods used will, as time permits, reduce this unaccounted for water to under 10 per cent of the total supplied.

Commission Management a Boon

Incidentally, the Water Department in Fergus Falls is under the same management as the electric utility. During the period under discussion, parallel arrangements with methods, records, etc., were made, with the result that reduction in cost occurred in a like manner in the electric department. This made it possible for the Water and Light Commission to also reduce the rates in the electric department to a point where they are among the very lowest in the country. All pertinent records concerning the plant are kept by one bookkeeper-stenographer who maintains the meter reading books for the 1945 water meters and 3,093 electric meters on the system, both of which are read monthly. The actual billing and collecting is done by another clerk. When these facts are considered, credence is lent to the statement that useful data is possible in smaller utilities without the development of red tape.

The Water and Light Commission of Fergus Falls is at present composed of V. C. Jensen, President; John A. Knoff, Commissioner, and H. E. Swenson, Commissioner. They are appointed to office by the City Council for staggered terms of three years and serve without compensation. During the period under discussion, the Commission has consistently followed the policy that the affairs of the utilities are to be carried on in a business like and impartial manner. They followed this policy because they were convinced this was the only method which would make it possible for the department to deliver to the consumer quality products not only at cost but at reasonably low cost. Creditable evidence of the soundness and success of the policy is believed offered by the fact that although rates were reduced approximately 35 per cent, a product is now offered much superior to that which was delivered at the high cost. Furthermore, charges for water have been reduced to a point where they are not unreasonable when compared with that delivered by other utilities.

EFFECT OF THE WAR ON WATERWORKS OPERATIONS IN CANADA

By ROSS L. DOBBIN
General Manager
PETERBOROUGH UTILITIES COMM.
PETERBOROUGH, CANADA

CANADA'S enormous program for manufacture of munitions of war has thrown greatly increased load on the waterworks systems of the Dominion.

Before the War, most of the large industries were located in Quebec and Ontario, and when the country was faced with the necessary expansion of heavy industries, some attempt was made to set up new plants in places where there had not been many industries before. But, it was soon found that skilled management was the hardest item to secure, and this was largely to be found only in existing industries. In consequence the Government was soon forced to look to the expansion of existing industries.

It has been found that industrial building and house building go hand in hand. In order to get the men and women to work in these new factories the country has been scoured for likely material. The Western prairies and the Northern mining districts have all contributed their quotas, and the result has been that the larger industrial cities in the East are crowded with strangers wanting housing.

Housing Agency Doing a Good Job

The demand for housing has been met by the construction of thousands of semi-prefabricated houses, and by crowding extra families into existing buildings. The building of these houses for war workers has been handled for the Federal Government by Wartime Housing Limited. This

The Author

is a wholly owned Dominion Government agency, which undertakes to build these houses where required with money supplied from Ottawa. This agency has been very well run, and the cost of the housing units has been remarkably low.

Water Demand Increase Runs to 25%

All this has resulted in increased load on the waterworks systems of the country. Many of these have experienced as much as 25 per cent increase in consumption of water in a year.

Some waterworks plants were in good shape to stand this increase at first, but now, nearly all face the necessity of, in some way, increasing their capacity to produce or to deliver water.

In the face of scarcity of critical materials and stiffer priority regulations, this is a difficult job. Some substitutes can be devised, but in the main, new construction must use large quantities of materials that are required in direct war materials production.

The Pipe Problem

Cast iron pipe can only be secured by permission of the Metals Controller, and in large sizes is practically not available. It is unfortunate that large sizes are required at the present time to increase the delivery of water. It is also unfortunate that such alternatives as wood stave pipe and asbestos cement pipes which might be used instead of cast iron, are not available because of insufficient manufacturing facilities.

As far as the materials for operation of the waterworks systems are concerned, these are being supplied in sufficient quantities at the present time. The new type of alum has not yet come into use, and when it does, it will bring its attendant problems.

Women are filling more and more the former positions of men, and in clerical jobs this is sometimes an improvement. But they will hardly be able to take the place of the much needed ditch digger and trench worker.

New Selective Service Regulations

The new regulations for Selective Service have just been announced, and it is too early to decide their full significance. In the main, these regulations provide that no person can leave his job without giving seven days' notice, and no person can be discharged without this notice. *No person can be hired except through and with the permission of the Federal Employment agencies.*

This is the second of two interlocking articles, by Mr. Dobbin, relating water utility experiences in Canada under the Dominion Wage and Price Control Acts and other of Canada's wartime regulations as they have affected water works operation, management and procurement of materials.

Mr. Dobbin's earlier article on the workings of the wage control acts, as it has affected water works operation and finances, is to be found in our August issue. It is well to read Mr. Dobbin's first article in view of what appears to be coming in the way of wages and price control regulations for this country.

As to the permissibility of water rate increases in Canada, it is our understanding (from remarks made by a price control authority before the Canadian Section of A.W.W.A.) that when good cause can be established it is possible (though not easy) to secure a rate revision in Canada. However, it was interesting to hear that where a municipality is operating more than one utility, if the water utility is operating at a loss while a profit is being realized from the other utility no rate increases are permitted as long as the joint returns from both utilities does not show a resultant net loss.

Advertisements for labor cannot state the firm name, but must refer applicants to the agencies.

The Labor Problem Becoming Acute

Labor is getting to be a problem for waterworks departments. All fit young men have enlisted and the older men remain. Men who were due for retirement have been retained in service, and the vacancies filled with older men from other occupations. They are suitable for the office or for positions requiring a moderate amount of physical work. The greatest shortage is in common labor of good quality. All the good men are either in the fighting forces or in the factories which offer so much more attractive wage rates.

One problem will be for those waterworks departments that employ large crews of laborers in the summer months, but have not much work in the winter months. If these laborers are laid off in the Fall, they will all find jobs in the factories and will not be available in the Spring.

It is going to mean that water consumers will not receive all the good service they have received in the past, and the available capacity will have to be shared amongst them.

Water Rates Under Strict Control

Water rates in common with other utility rates were brought under the Wartime Prices and Trade Board regulations establishing a ceiling. Water rates cannot be increased over pre-war figures. However, in many cases this is not a hardship, and most waterworks departments have experienced large increases in revenue, without a corresponding increase in operation costs. This has been due to an increase in the number of consumers without increasing the investment in water mains, etc.

But there is a limit to this condition, and next year many waterworks departments will have to use all their skill and ability to meet the rising demand for water. The use of water for lawn and garden sprinkling and for street watering will likely have to be reduced, among other services.

The Federal Government has just now, (September 1st) issued an order by which no utility service can be constructed to new buildings without first receiving permission from the Metals Controller. This order is in line with the amendments of the P-46 United States Operating Order which instituted restrictions as of July 1st, 1942. What effect this will have on building of all kinds, it is too early to ascertain. However, where houses are scarce and required for munitions workers, there is no doubt that permission will be given for the use of the necessary piping, wiring, etc.

There are other regulations which will greatly affect waterworks operations, and more will be heard of them as time goes on.

All of this means that Canada is at last fully settling itself for a Total War Effort, in which all civilian and personal activities will be subjugated to War activities. In this direction the Dominion's waterworks systems will take their fair share.

Without much question, many of the regulations as to labor supply and materials will continue after the War. They will be found to be so beneficial and efficient that we will not wish to abandon them.

Are You an "Authority"?*

It is quite possible that you are an "authority" on some phase of some subject without knowing it.

If you have a hobby, for instance —and we all should have some sort of hobby—you may be an authority on that hobby.

There are various degrees of authority. A hundred years ago James Watt was an authority on steam engineering matters, but if he should come back to earth today he would have much to learn. Many authorities who died one hundred years ago and whose names are revered now would not be regarded as authorities today if they could learn no more than they knew then.

In the same way authorities of today are mere infants in knowledge or will be so regarded one hundred years hence. We really know so little as compared with what there is to know that we have no cause for boasting.

There are some people on this earth, however, who are "know-it-alls" and who look into a technical or trade publication apparently for the sole purpose of finding fault rather than to learn something. They find an article that is elementary and is intended mostly for beginners, and with a gloating ha ha the publication is thrown aside with the remark, "That paper is no good."

The writer admits that he is writing this largely in self-defense because he has frequently been criticized for writing elementary articles and for making mistakes. There is no denying the mistakes, some of them seeming very foolish to readers and they were embarrassing after they were pointed out. But, then, who HASN'T fallen down? The writer has fallen more than once. Editors, too, fall down. In one outstanding instance the writer made a statement that was correct, but the editor altered it in such a way as to make it wrong. And was the editor's face red when it was proved to him that he had changed a right into a wrong.

The principal function of any serious publication is to teach. Every word in the publication from the first advertisement on the first page to the last advertisement on the back page should be instructive, and it has been the writer's experience that most publications do instruct. The editorial pages should contain editorial opinions, should contain the results of experience of readers, should contain news items, notices of meetings, notices of new catalogs published by manufacturers, etc. The publishers, on the whole, are doing their very best toward advancing knowledge. Could the scoffer do better? The writer wonders.

Bearing in mind the fact that future generations will be amused to some extent at least by our present elementary knowledge, which reminds us that "Authority," like motion, is only relative.

*Contributed by W. F. Schaphorst, M.E., Newark, N. J.

"A Thought for the Day"

The following bit of British philosophy has been reprinted and distributed by Atlas Mineral Products Co. We are reproducing it as a "Thought for the Day"—a day that we hope will never come to America.

"If you live in Britain you are one of two things. You're either in a dangerous area or you're not."

"If you're not, you needn't worry. If you are, you're one of two things. You are either bombed or not."

"If you're not, you needn't worry. If you are, you're one of two things. You're either injured or not."

"If you're not, you needn't worry. If you are, you're one of two things. You're either seriously injured or not."

"If you're not, you needn't worry. If you are, you're one of two things. You are either dying or not."

"If you're not, you needn't worry. If you are—you can't worry much longer."

"So there's NO NEED TO WORRY at all, ever!"

Priorities Letter No. 5 Issued by W. & T.

TO MANY operators and managers, Wallace and Tiernan Co.'s series of "Priorities Letters," prepared for general distribution as rapidly as important changes appear in priorities orders and regulations, have been extremely informative and helpful. Particularly is this true because of the helpful interpretative statements made by T. T. Quigley, as manager of W.&T.'s Priorities Department, which accompany the various new orders or revisions supplied in complete form.

W.&T.'s "Priority Letter No. 5" covers all of the most recent changes (those issued during June and July) and, for the benefit of those who may not be familiar with the more important changes, we call attention to the following comments:

Since June 23rd, under the amended W.P.B. Order P-46, water and sewage utilities are permitted to order critical materials required in cases of actual breakdown, *or for prevention of threatened or expected breakdowns,* under an A-1-C rating. This high preferential rating, however, can only be applied to the extent of 30 per cent of the purchases of materials ordinarily allowed in any given quarter under the A-5 rating applicable for routine maintenance and operation of water distribution systems or sewer collection systems, and for the A-2 rating applicable to pumping stations and/or those more vital water purification or sewage treatment facilities. (In Order P-46 the A-2 rating is allowed for pumping and production. "Production" being interpreted to mean the production of pure and wholesome water or safely treated sewage effluents.)

In Priorities Regulation No. 3 (effective since July 1) the method of applying priorities to orders for materials and equipment is further simplified. It is now only necessary to indicate the rating allowed opposite each individual item on a purchase order and, thereafter, endorse the following certification on the order; or it may be attached to the order if such order is effectively identified in the separate certification by noting the order serial number.

Certification:

"The undersigned hereby represents to the seller and the W.P.B. that he is duly entitled to apply or extend the preference ratings indicated opposite all items shown on this purchase order, and that such application is in accordance with Priorities Regulation No. 3 as amended, the terms of which are familiar to the undersigned."

——— Signature and Title.

(Note: The signature must be by the hand of an official duly authorized to issue orders and make purchases.)

In the event of an emergency, wherein the rating permitted under Order P-46 is not sufficiently high to obtain the required material promptly, an emergency rating of higher rank may be requested. In such a case the superintendent or manager should personally make the telephone call (and safer, also send through a wire) to the Power Branch of W.P.B. in Washington. [If he has a W.P.B. field office nearby he would do well to seek their assistance as well. Further than that he may telephone the supplier, from whom he hopes to secure the material or equipment, of the situation. The supplier may be able to assist materially in reaching the proper authority in Washington, with the minimum of hurdling of red tape procedures and least expense and loss of time. Note: Nothing within these brackets is suggested in the W.&T. letter of interpretations and suggestions. These statements are based entirely on the knowledge of the writer as to what may be done in a real pinch.—Ed.]

The request for the special emergency rating must be amply supported with the following information:

(1) Time, extent and cause of breakdown.

(2) Degree of emergency and defense load (if any) carried.

(3) Detail of material needed and value. (Make out a purchase order and give number for future identification when it reaches the supplier.)

(4) Give name and address of supplier.

(5) State what rating seems necessary to obtain the material in the time permissible.

Another Important Change

Another important change in priorities procedure is made by Priorities Regulation No. 10 recently issued. It establishes what is known as an Allocation Classification System, and a list of the Purchasers and Use Allocation Symbols and Numbers has been issued. The purpose of this system is to provide the War Production Board with a means of tracing materials all the way from the ultimate consumer back to the basic raw materials and it is absolutely essential that all orders, with the exception of those valued at less than $15.00, carry the appropriate Allocation Classification Symbol. If this symbol does not appear on your order, in addition to the necessary priority, the manufacturer will be unable to schedule the material for shipment until the proper classification has been established. This system does not replace priorities but rather supplements them in an effort to allocate sufficient raw materials to important end uses regardless of the particular priority rating which may apply. For orders for existing water and sewage systems the symbol is DP-12.10.

It is well to remember, too, that ratings A-2 and A-5 apply only to maintenance, operation and repair —not to capital equipment—i.e., new additional equipment. In the latter instance it is necessary to make application on a PD-1A form for priority rating before the supplier can furnish the equipment. This form may be secured from W.P.B. in Washington or any District Office. In filing these forms (very simple in themselves) it is increasingly important to append a *full* explanation of why the new machine or piece of equipment is needed. Don't be too brief in your statement for if so you will assuredly be required to give full details and argument supporting the need before the rating is granted by the Requirements Branch or the Power Branch of the W.P.B.

Since matters pertaining to priorities are getting tougher all the time down at Washington, we would urge every superintendent and manager to become thoroughly familiar with the most recent issue of amended Order P-46 and *follow the rules.* Also not to overlook using the new Allocation Classification Numbers and Symbols in addition to the Priority Rating. If these revisions and symbol list are not already on hand we urge you to secure copies from W.P.B. direct, or to avail yourself of the service that Wallace & Tiernan Co., Newark, N. J., is rendering in the gratis distribution of copies of these orders and lists to those requesting such.

SYMBOL of FREEDOM

Silent and awestruck stood the early explorers and adventurers who dared the wilderness to gaze upon the great Falls at Niagara. And year by year in story and legend its fame grew—until Niagara became a symbol of a great and glorious new country. Free, untamed, resistless, it spoke in resounding tones of a land of far reaching spaces... broad rivers... tall mountains... fertile valleys... and boundless opportunities.

Like the river at Niagara, a stream of humanity broke away from its ancient, sluggish ways. It plunged into swift-moving rapids. It flowed through the hills and valleys of America. It built cities and farms, turned desert waste into rich farm lands, created mills and factories, gave birth to a new and better way of life for which we are all fighting and working today. And still this river of humanity flows on! The truth of its progress and its ideals are echoed throughout the world. And still Niagara flows on—symbol of the restless energy, the limitless abundance that is America.

We who work within sight and sound of Niagara Falls are devoting every ounce of our energies and facilities to speeding the flow of Chemicals for Victory.

CAUSTIC POTASH · CAUSTIC SODA
PARA · CARBONATE OF POTASH
LIQUID CHLORINE

FROM THE ORIGINAL BY FRANCIS CRISS... IN NIAGARA ALKALI COMPANY'S COLLECTION OF PAINTINGS OF NIAGARA FALLS

Niagara ALKALI COMPANY

60 EAST 42nd STREET, NEW YORK, N. Y.

METALLIZING*

As a Method of Water Works Maintenance

By C. E. PALMER
President†
PALMER FILTER ENGINEERING CO.
ERIE, PA.

BEFORE proceeding with the paper I am about to give, I wish to state that Mr. James S. Dunwoody, former General Superintendent of the Erie Water Department, was to have appeared before you with a paper on this same subject.

In Mr. Dunwoody's sudden and unexpected death on March 21 of this year, this Association lost one of its most loyal and conscientious members. The City of Erie and the Erie Water Department, an outstanding citizen and leader that it will find hard to replace.

In this paper I shall attempt to describe some of the many ways that the process of "Metallizing" has proved a boon and a money-saver to the Water Department of Erie, Pa.

The Author

In the writer's opinion, the value of "Metallizing" in the water works maintenance and repair cannot be over-estimated. It's adaptability to numerous applications now clearly indicates and the test of time has proven that both corrosion and wear can be effectively and largely eliminated.

First Application 1930

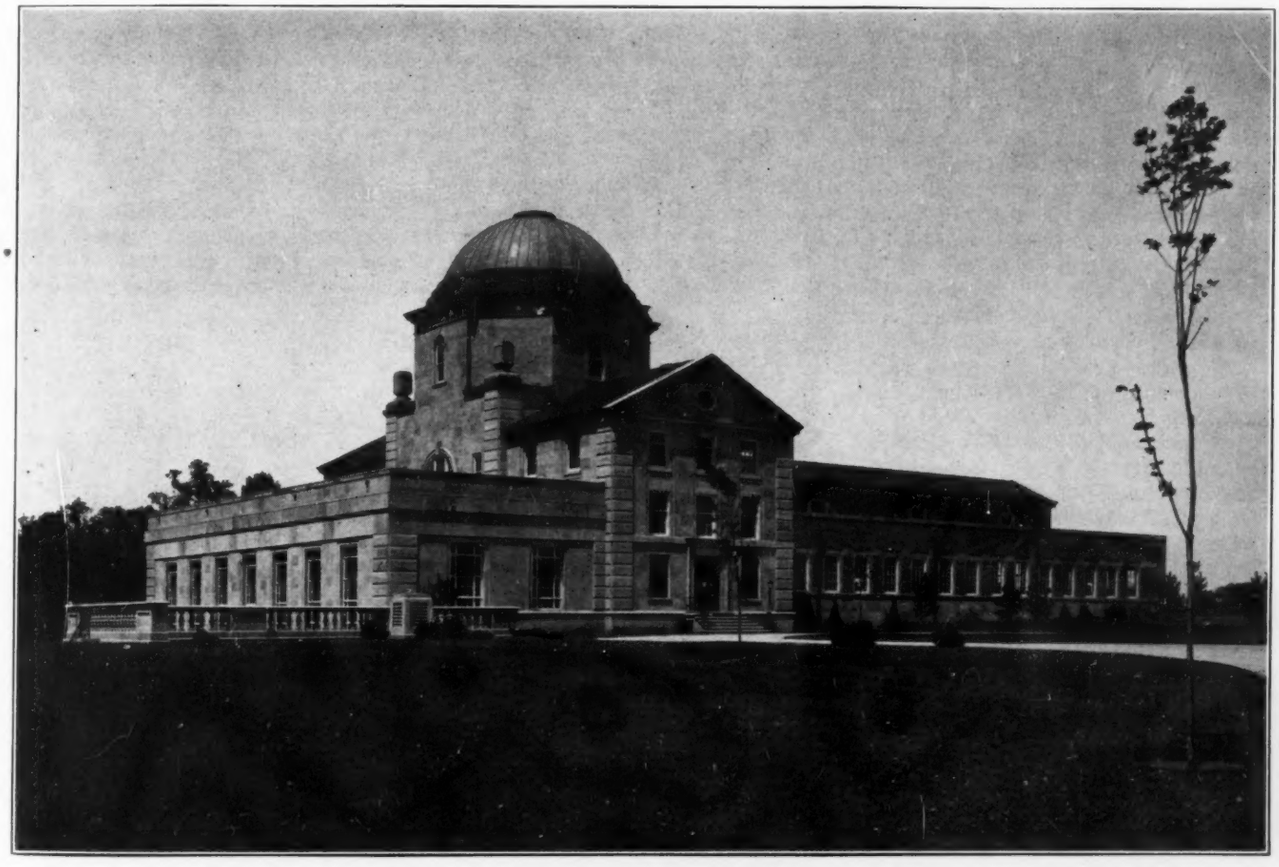
In 1930, the Erie Water Department approved the spraying with zinc of all of the bolts and nuts used in the construction of the West Plant intake pipe, which is a 72-inch riveted steel line 8,800 feet long.

A 72-inch built-up steel ball joint which was placed on the Lake side of this intake line was also metallized with zinc, both inside and out. As this work is entirely submerged below the Lake bottom, it, of course, has never been inspected.

After eighteen months of service the 110,000-gallon steel wash water tank serving the West Filtration Plant showed signs of heavy corrosion and pitting on the interior. As

*A paper read before the A.W.W.A. conference on wartime water works problems and printed by permission of the Association.

†At the time the metallizing work recounted in this paper was done Mr. Palmer was chief operator at the Erie, Pa., filter plant, where the work was done under his supervision.



The West Filtration Plant and Pumping Station, Erie, Pa.

Under the dome is the 32 ft. diameter wash water tank, zinc coated in 1934 by the "Metallizing" process, and showing no deterioration after 8 years of service. Our second experience in applying a protective film of sprayed on molten metal.

the continuous service of this tank was essential to the efficient operation of the plant, the thought of having to take this tank out of service every eighteen to twenty-four months for painting was quite disturbing.

Having used metallizing on submarine work, it was decided that this modern method of protection should be given a trial on the inside of this wash water tank where it could be readily inspected and carefully checked at regular intervals.

Second Use on Wash Water Tank—1934

This being our first field job, the work was done by contract, which called for the blast cleaning and metallizing with zinc of the interior surfaces only. The tank in question is open at the top, 32 feet in diameter by 19 feet 3 inches deep. The method used by the contractor was to sand-blast an area just large enough to permit two applications of zinc each day, thus assuring a completed surface every day which would not be affected by the dust created by subsequent blasting on an adjoining area. The final zinc coating required was .006 of an inch. Work was started in May, 1934, and completed in about three weeks' time.

A careful inspection given a few weeks ago after eight years of uninterrupted service showed no sign whatsoever of the coating having failed. Had an attempt been made to protect this surface with paint during these past eight years, there would have been periods of suspended service lasting for at least three weeks. Moreover, we would have had to look forward to repeating this time-taking procedure at the same regular intervals and the tank would have become more deeply pitted after each operation. Now, however, with no indications of a breakdown in the zinc coating, which has been in continuous service for a period of eight years, there is good reason to believe that the metallized surfaces will give many more years of perfect protection.

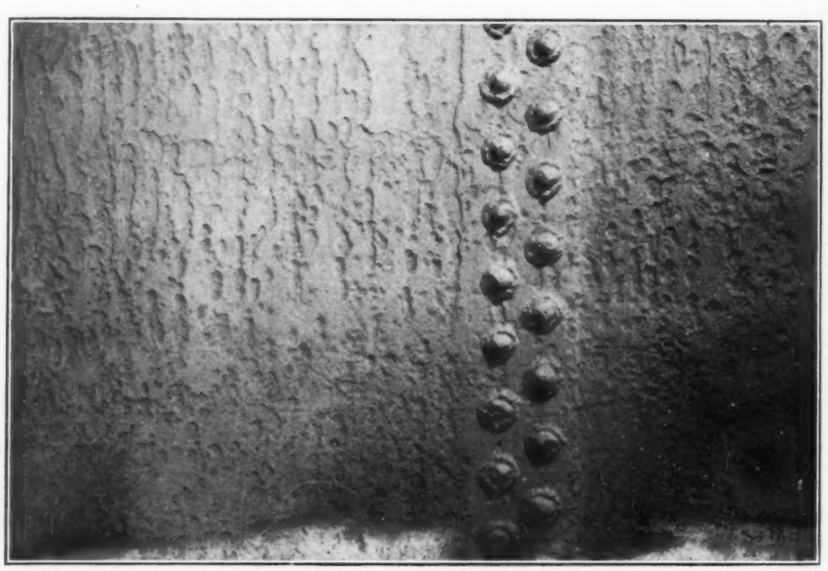
In making comparisons between metallizing and painting, of course, cost must be a primary consideration. Disregarding interruptions in the service, which in the case of the tank referred to are important, a metallized job will cost from two to two and one-half times as much as a good paint job. Nevertheless, it is very apparent that sizable savings can be made over a period of time. Eight years of service in this particular case has not been sufficient time to even estimate what the full-protection period will be.

Interior Section of a Badly Pitted Tank After "Metallizing" with a Coating of Zinc to a Smooth Surface

Later, Metallizing Saves Replacement of Filler Troughs

Erie's first Filtration Plant was put into operation in 1914. At that time, twelve filters were constructed. They were of the two-bay type, each bay being 12 feet 6 inches wide by 28 feet deep. Each bay contained four steel wash water troughs running the short way of the filter. Four filters having the same plan dimensions and containing the same number of troughs were added to this plant in 1925. Maintenance of the steel wash water troughs in this plant, which now consists of 16 beds and a total of 128 troughs, had become a troublesome and costly proposition. In spite of a complete scraping and painting job every two years, during which time all kinds of special primers and paints were tried, the troughs originally installed had become deeply pitted, both inside and out. In fact, where the inside and the outside pitting had taken place in the same spot, holes were found ranging in size from a pin point to one-quarter inch in diameter.

As the condition of these troughs necessitated immediate action and as previous experience had indicated the value of metallizing, it was decided to purchase the necessary



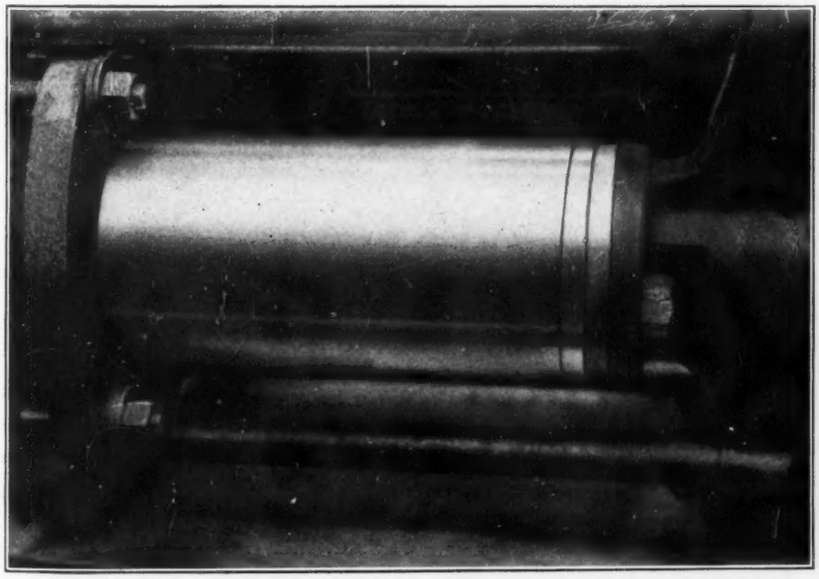
Interior of the Same Tank After Wall Preparation for the Zinc Coating. Note That Pitting Was Quite Pronounced

"Metallized" Filter Troughs Which Had Been Pitted Through in Spots and Ready for Replacement Otherwise

equipment and to proceed with the rehabilitation of these troughs by spraying them with zinc.

To prepare the troughs properly for metal spraying, while in position in the filter, presented a rather difficult problem. As steel grit was to be used for blasting, it was necessary to prevent this from flying all over the plant and also to reclaim this grit for further use. This was accomplished by removing enough sand from each half of the filter under treatment to allow the operator to blast and properly spray the under side of the troughs. Heavy tarpaulins were then spread over the entire sand surface and a light framework was built over and above the open section of the filter. This framework was then covered with heavy drop cloths and was so constructed that it could be readily moved from filter to filter as the work progressed. Because of the distance from the blast nozzle, this tent or cover prevented the steel grit from flying out and caused it to drop back into the troughs or on the tarpaulin, where it was later reclaimed, cleaned, and then returned to the blast machine.

It was possible after ironing out many minor problems such as proper protection of the operators from the steel grit and filtering the gases and oil collected in the compressor from the air supplied to the operator's masks to blast and metallize one trough in an eight-hour day. A total of approximately .006 of an inch of zinc was applied in three coats. All holes were filled with the sprayed zinc at the time this coating was applied.



One of the Seven Pump Pistons Undercut 1/16", Built Up With Stainless Steel by the "Metallizing" Process, and Reground to Exact Size

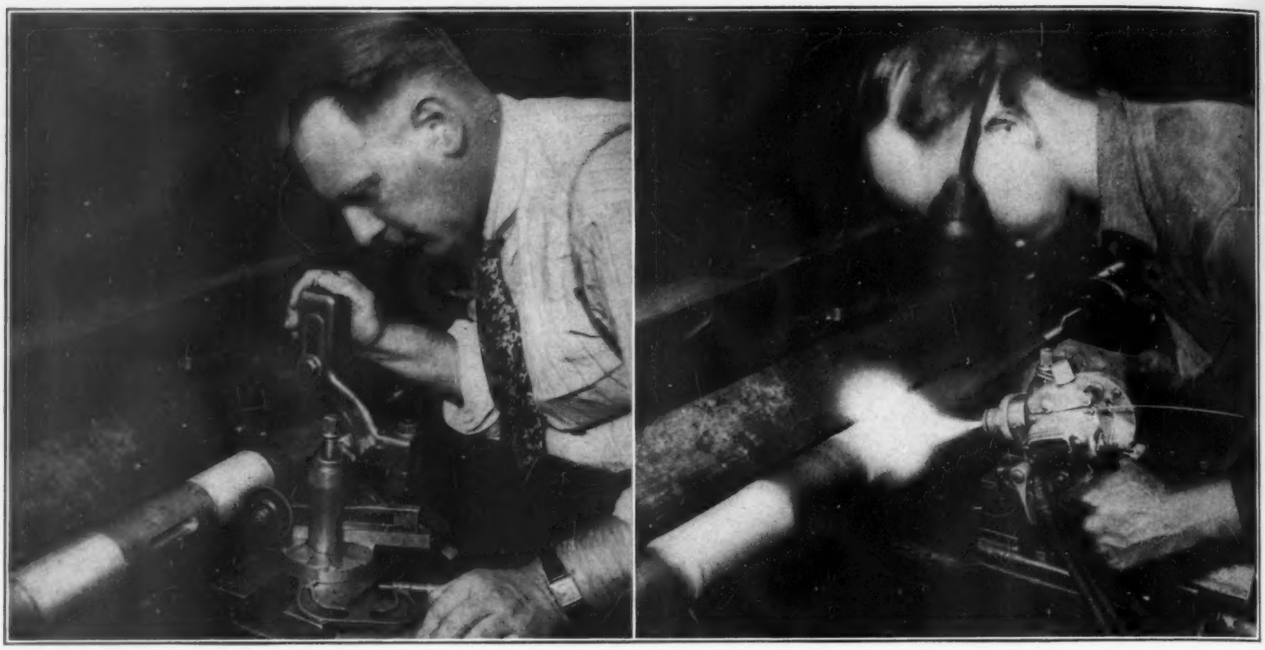
Cost of Filter Trough Work

Work on these 128 troughs was started in March, 1936, and completed in October of that year. The total surface area of the 128 troughs is 12,432 square feet. The total cost of metallizing these troughs was $7,962. Of this amount, $4,526.63 was charged against labor and included the cost of removing and replacing the sand in each unit; also the rough scraping of each trough before grit blasting, which eliminated a considerable amount of dust and thus speeded up the blasting process. About 3,700 pounds of zinc wire were required and it must be remembered that many holes in the troughs were filled and that the 1½-inch angles riveted to the troughs near the top edge were completely sealed off at both the top and bottom edges of these angles. About 10,134 cubic feet of oxygen and 7,237 cubic feet of acetylene gas was used.

While no estimate was made of the number of cubic feet of air required, the cost of this item for gasoline, oil, etc., used in a motor-driven Ingersol-Rand two-stage compressor, delivering approximately 160 cubic feet of air at 100 pounds pressure, was in the neighborhood of $800 on this job. Of course, the greater part of the compressed air was required for the grit blasting with a relatively small amount used for the metal spraying operation.

In summing up the above, it will be found that the cost of metallizing each trough was $62.20. When you consider the fact that these troughs would soon have had to be replaced and that not one cent has been spent on trough maintenance since 1936, some idea of the savings made possible by metallizing in this particular case can easily be determined.

Between December, 1936, and May, 1937, the 64 steel troughs in the eight filters at the West Side Plant were metallized with .006 of an inch of zinc. These troughs being both wider and deeper than the troughs at the Chestnut Street Plant, had a total surface area for the 64 troughs of 7,976 square feet. The total cost of this job was $4,681. This work was carried out in a similar manner to the Chestnut Street job, and because of the experience



Two Steps in the Process of Rebuilding a Worn Shaft, Rod, Piston, Etc.

On the left the shaft is being undercut with the special Metco knurling tool. On right the prepared section is being built up with stainless steel. An oxy-acetylene flame in the Metco gun melts the stainless steel wire at the rate set by the operator. There is no fusion bending between the two metals, merely a jacketing process. These views happen to be of a shop job of placing stainless steel bearing insets in a propeller shaft, but pictures the method used in Erie. The third operation, not pictured, is that of grinding and polishing.

gained on the first job, the cost on a square foot basis was somewhat reduced. The Chestnut Street job having cost slightly over 64 cents per square foot and the West Plant job about 58 cents per square foot.

While touching on the subject of costs, I think that I should point out that there are many items that enter into figuring costs of various metallizing jobs, both of a similar and dissimilar nature. For instance, let us consider two tanks of the same size, one located on the ground and the other an elevated storage tank some 100 feet above ground. The cost of handling necessary material in the latter case would, in itself, greatly increase the cost. The cost of furnishing compressed air for blasting would also be considerably increased. While on this subject, I might add that both blasting and metallizing equipment have been considerably improved since 1936, with a consequent reduction in the cost of all types of metallizing work. For instance, with the metal spraying equipment then available, we were limited to the application of from 8 to 10 pounds of zinc per hour. With modern equipment, zinc can be applied at the rate of 30 pounds per hour, and the density of the spray is automatically controlled with one type of metal spray gun now available.

Other Uses of Metallizing at Erie

Let us now consider a few of the many other uses found for our metallizing equipment, both for corrosion protection and the rebuilding of worn surfaces. At the West Filtration Plant the coagulating basins are drained by plug valves in the floor. These valves are operated from the roof of the basin by means of steel rods 22 feet long. After four years of operation, heavy corrosion was noted on these rods. By the application of zinc, all further corrosion was checked and replacements of the rods avoided.

Coating Pitted Boiler Water Softener Tanks

An inspection of steel tanks used in connection with a zeolite water softener at the boiler plant revealed, after 13 years of operation, serious pitting of the interior surfaces, especially at the riveted seams. Caulking and exterior welding had been used to stop these leaks, but after a thorough interior inspection the real cause of the leaks was found to be corrosion of the interior surfaces of these tanks. To correct this trouble at the source, both of these tanks were blasted on the inside with steel grit and metallized with about .008 of an inch of zinc, particular attention being given to the riveted areas and seams where additional metal was used.

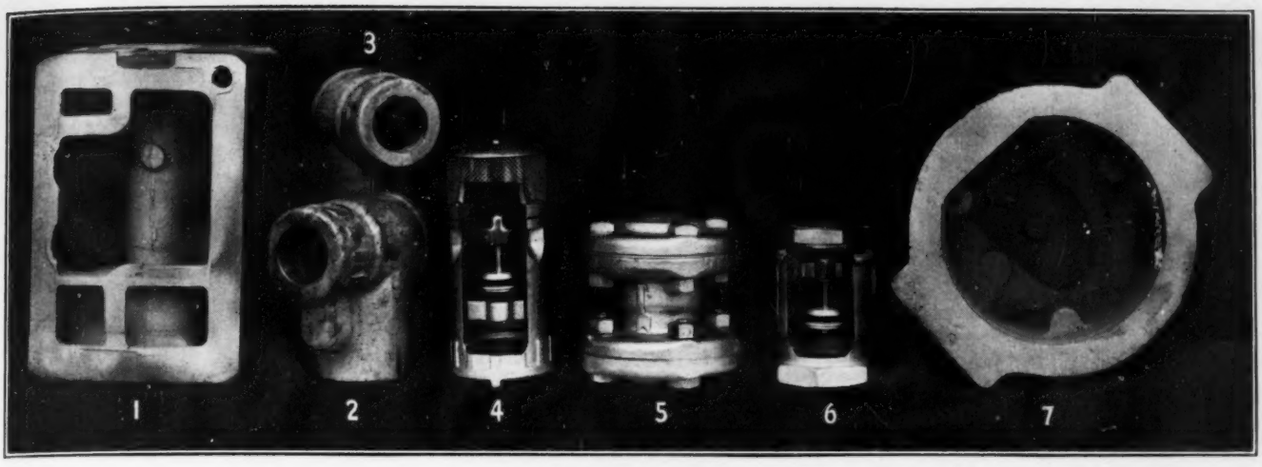
Since this treatment was completed, over a year and a half ago, all seam leaks have stopped, and while no interior inspection has been made to date, we feel certain that further corrosion has been completely checked. Greatly improved operation and a reduction in the amount of salt used for regeneration has also been noted. Most important is the assurance of continued service from these tanks which would have soon required replacement if corrosion had not been arrested.

Other applications for the prevention of corrosion included steel ladders in the basin and reservoir, rods exposed to constant moisture or completely submerged, sluice gates, and, in fact, all metal surfaces subject to rapid oxidation.

Rods, Shafts and Bearings

The metallizing process has other important values to a water works in the restoration of worn or scored surfaces. Many bronze and steel valve rods which had reached the point of replacement because of wear were restored to service at a cost considerably under replacement charges. By proper selection of the metal to be applied, rebuilt rods give much longer and more satisfactory service than the original rod or stem.

The impeller shaft of an 8,000,000-gallon per day motor-driven centrifugal pump on which the bronze sleeve over the steel shaft had been completely worn through by the fric-



Some "Metallized" Parts

(1) *Rotary pump casing;* (2 *and* 3) *angle check valves;* (4) *foot valve;* (5 *and* 6) *line check valves;* (7) *meter case.*

tion of the packing was restored to service by under-cutting this worn section and refilling this with sprayed stainless steel. This was then ground to a finish and has been in service for several years without any indication of further wear.

Pump Pistons Rebuilt

Another important job done at the Erie plant was the rebuilding of eight outside packed feed-water pump plungers. These plungers, 6 inches in diameter by 20 inches long, were cast of gray iron, and previously would show considerable wear and noticeable scored and pitted areas after a short period of operation. High-grade and expen sive packings were tried to no avail and it was necessary to repack the glands after each two or three months' service. After about four years of service, it was also necessary to replace the plungers.

About four years ago the first of these plungers was repaired by undercutting the surface of the plunger one-sixteenth of an inch for the entire length of the stroke. This new surface was then prepared for metal spraying by use of a special knurling tool which roughens the surface to be sprayed and tends to open the pores of the metal, thus assuring a good bond between the prepared surface and the sprayed metal.

I might add at this time that the bond between the metal to be sprayed and the sprayed metal is entirely mechanical in nature, inasmuch as the metal to be sprayed is not heated to a point of fusion. The bond is obtained by forcing the sprayed metal, which is in a molten state, into the pores and roughened surface of the metal to be sprayed.

In the early stage of metallizing, this process was given many a setback simply because the user had failed to consider the importance of a properly prepared surface.

To get back to the plunger we have undercut and prepared for metal spraying, our next step is to fix the metallizing gun to the carriage of the lathe with the nozzle about 6 inches from the work. In this case the work should be turned at the approximate number of revolutions per minute that will give a surface speed of 50 surface feet per minute. The carriage speed should then be adjusted to about one-sixteenth inch per revolution. The metal used for spraying (in this case Metcoloy No. 2 Stainless Steel) was now applied in thin layers by moving the carriage of the lathe back and forth until the new metal had reached a thickness equal to about .002 inch over the original diameter. The rebuilt plunger was then ground smooth and to exact size.

Surprising as it may seem, this plunger after nearly four years of operation shows a smooth glass-like surface without a pit or score mark visible. The chief engineer reports from his record that the original packing is still in the gland and that the gland nuts have never been tightened since the gland was first packed. All of the seven remaining plungers were built up in this manner a few months after the first job had been completed and the same amazing results are being obtained in each case.

Other Experiences

A recent and careful check-up of work done under my personal supervision in many industrial plants in Erie, which included the building up of all kinds of worn parts from small pump rods to a large paper mill beater shaft, showed that in every instance the built-up sections are giving more satisfactory operation and much longer service than the original pieces.

Where wearing parts are concerned, this longer service can be attributed to the proper selection of the metal or alloy most fitted to the job and also to the fact that sprayed metal has a tendency to absorb and hold lubrication more readily than other metal surfaces. While the Erie Water Department was one of the first to use metallizing for maintenance work, it is not the only department having used or making good use of this modern means for protection and other maintenance. There are many water storage tanks throughout the country that are now protected in this manner, some only inside others both inside and out. The St. Louis County Water Co. has also made extensive use of metallizing for rebuilding worn surfaces. There are, without doubt, many other water departments that have made use of or are using this equipment.

Time will not permit me to begin to touch on the many and varied applications where metal spraying is now saving time, money, and of even greater importance at the moment, much valuable material.

Something of the History of Metallizing

Let me make it clear that this process is not a new or untried procedure, but is one that has stood the test of time and rigid investigation in all instances.

As a matter of history, metal spraying was first tried in Switzerland as early as 1910, and from a not too promising start has evolved into one of the most valuable time and money-saving processes available to industry today. Some com-

prehension of the great variety of things that can be accomplished by the use of this equipment may be gathered from the statement that its possibilities range all the way from making bronze book-ends from baby's first shoes to the repair and rebuilding of the largest steam turbines and water wheels. In closing and as a brief resumé of things previously mentioned, I would like to point out that metallizing is a highly developed and widely established method of spraying molten metal on metal or any other properly prepared surface. It has been successfully employed by all branches of industry for many years and warrants the immediate attention of everyone concerned with maintenance of vital plant and shop equipment.

The most commonly used metals for spraying are lead, tin, zinc, babbitt, aluminum, bronzes, brasses, copper, nickel, monel, iron, steels (high, medium and low carbon, and stainless). No heat is applied directly to the base material at any stage of the process. Consequently, there is no warpage, no distortion, no heat strains or stresses, no interferences with the characteristics of the base material whatsoever.

With metallizing you can replace metal removed by wear, correct surface defects, increase outside diameters or decrease inside diameters, impart desired mechanical, chemical or electrical properties, apply metal to non-metallic materials.

Equipment that is metallized lasts longer, requires less maintenance, fewer costly shut-down periods. This is due to the fact that in most instances you can apply coatings of metals that are more wear-resistant or more corrosion-resistant than the metal originally used.

Today, immediate replacement of many worn and damaged parts is virtually impossible. You can keep equipment running by metallizing parts that ordinarily would be discarded. With metallized coatings of corrosion-resisting metals you can effectively protect tanks, kettles, vats, ventilating system, and other plant equipment against further deterioration. Such coatings will withstand the attacks of industrial fumes and gases, hot and cold water, brine, degreasing compounds, and many acid and alkaline solutions.

The ever-tightening war requirement of metals demands that waste be kept to a minimum and eliminated wherever possible. Metallizing can serve in many ways to reduce waste, eliminate corrosion, save time, and keep equipment running. Thus, it becomes a vital tool in our "Drive to Victory."

Western Pennsylvania Water Conference Proceedings Issued

ELSEWHERE in this issue is a paper which was presented at the Second Annual Water Conference of the Engineer's Society of Western Penna. which was arranged under chairmanship of H. M. Olson, sponsored by the Society, and held in Pittsburgh last fall.

The 152-page printed proceedings of the Second (1941) Conference are now being offered at cost of production—namely $2.15 per copy—by the Engineer's Society of Western Pennsylvania, which maintains headquarters in the Wm. Penn Hotel, Pittsburgh.

Contents of the Proceedings embrace amongst others the following papers of particular interest to our readers.

Contents in Part

Characteristics and Cost of Corrosion. By F. N. Speller, Session Chairman.

High Lights in Corrosion Research. By V. V. Kendall, National Tube Company.

Status of Cathodic Protection in 1941. By Dr. K. H. Logan, Chief Underground Corrosion Section, U. S. Bureau of Standards.

Role of Bacteria in the Corrosion of Iron and Steel. By Arba Thomas, American Rolling Mill Co., Middletown, Ohio.

Plant Results with Threshold Treatment. By Owen Rice, Calgon, Inc.

Use of Silicate as Corrosion Inhibitors. By Wm. Stericker, Philadelphia Quartz Co.

Water Pipe Corrosion Problems in Buildings. By H. L. Shuldener, Water Service Laboratories, New York.

The Effect of Dearation on pH Value. By J. D. Yoder, The Permutit Co.

The Removal of Dissolved Gases from Boiler Feed Water. By A. E. Kittredge, Cochrane Corp.

Chemical Laboratory for Water Treatment Control in a Power Plant. By Prof. Frederick J. Straub, University of Ill.

Synthetic Resin Exchangers and Their Application. By Dr. F. J. Myers, Resinous Products and Chemical Co.

Of equal value to the major papers are the numerous discussions prepared by other experts in their respective fields. We have not listed the several papers of more strictly industrial plant application—such as "Chromate Treatment in Corrosion Inhibitions"; "Turbine Deposits"; "Hot Process Softening"; etc.

The 3rd Annual Water Conference of the Western Penna. Society is to be held in Pittsburgh, November 9th and 10th, at the Wm. Penn Hotel again under chairmanship of H. M. Olson.

500,000 Million Horse Power in a Modern Bomb?*

This writer has been unable to learn the exact heat value of modern explosives, but he is informed that the heat value is less than gasoline and even less than that of coal. So let us play safe and say that it is 9,500 Btu per pound, or, about one-half the heat value of gasoline.

Modern bombs, such as they are dropping in and around Europe weigh from 2 to 3 tons. Let us consider a 2-ton bomb and assume that one-half of that weight is metal and mechanism and the remaining 2,000 pounds is explosive. 2,000 x 9,500 gives us 19,500,000 as the Btu's in the bomb. There are 778 foot pounds in a Btu, which, when multiplied by 19,500,000 gives us about 15,200,000,000 foot pounds. And there are 550 foot pounds in a horse power per second. Dividing that into 15,200,000,000 we get 27,600,000 h.p., which is the horse power of a "slow" bomb requiring a full second to explode.

But modern bombs are not slow. The writer is informed that the energy is given off in a 20,000th of a second, which means that we must multiply the above by 20,000. Therefore

$$27{,}600{,}000 \times 20{,}000 = 552{,}000{,}000{,}000 \text{ h.p.}$$

In other words—and it is believed that these figures are conservative—a modern bomb delivers 552,000 million horse power in a 20,000th of a second.

*Contributed by W. F. Schaphorst, M.E., Newark, N. J.

AESTHETICISM

And a Scheme for Keeping Fresh Water Fresh

By D. R. TAYLOR
Plant Superintendent
Roanoke Water Department
ROANOKE, VIRGINIA

MANY of our poetic ancestors often portrayed with impressive and colorful word pictures, old moss covered oaken buckets and curved handle gourds, with such cool and refreshing picturesqueness that one became thirsty with even casual perusal of their descriptiveness.

And we haven't yet outlived the supposedly irrefutable proof of the salubrity of country spring water as evidenced by the Adonic youth or large families with extraordinary longevity in the neighborhood. "It didn't take spinal adjustments and vitamin B pills to keep you healthy in those days." Nevertheless, science has with the aid of research, laboratories, test tubes, agents, reagents and what-nots, increased the average span of human life some ten years within the last century, yet they are few who know or stop to realize that the members of the water works profession are among those in the front line of this march of progress.

Mr. and Mrs. America Have Gone Aesthetic

Mr. and Mrs. John Q. Public have become increasingly demanding, and fastidiously exacting regarding their public services. They not only expect modern, prompt and utilitarian attention with no inconvenience, they even demand a product with artistic characteristics. They have gone æsthetic, if you please.

The train or bus may be on time every day for months without bringing forth a single expression of commendation, but just let either show up late just once and—"that's a heck of a note!" "Somebody must have been asleep on the job." Water service may be uninterrupted for years and then it does not even have to be entirely suspended to produce a veritable deluge of calls. A 50 per cent drop in water pressure seems to cause a 100 per cent rise of blood pressure and injured feelings begin to assert themselves—"What do you think we are"? This opening volley shot at you places you at the fork of the road. One sign points to the poorhouse and oblivion, by way of a rocky road with mud puddles of arrogance, poor judgment, inferiority complexes and despair. The other sign points to progress and success by way of a road paved with tolerance, human understanding, wisdom, achievement and happiness.

"Doc" Taylor

You know what they are, and might burn to say it at that minute, but a rank beginner in the most elementary class in the school of public relations would have sense enough to forego a frank statement of his thoughts on the matter, at the moment. A defiant attiude on his part at this juncture would be as suicidal to his well-being, as trying to smoke a skunk out of a powder magazine with a bunch of burning rags.

"I don't have time to spend the entire morning shaving." (It may have taken them two minutes longer this morning, but we doubt it, they probably overslept anyway.) "Why didn't you notify us that the water was going to be off"? (It wasn't really off.) "Suppose we paid our water bills like that?" (They probably get in just under the wire on the last payment date.)

Other than an expression of profound apologies and a brief reference to your inability to govern the acts of providence, you had better reserve your effort to prove your preeminence in technical discourse or to display your verbal outburst, for the newspaper reporter, who will surely be around to find out what happened. In this way your "case" is much more easily won when adjudicated amid such pleasant surroundings as is afforded by an easy chair in a den or a sun parlor, especially after the service is back to normal. During the battle is no time for debate or repartee. Strategy is supposed to be planned before the encounter, not in the middle of it.

Suppose we tried to serve them today from "the finest spring in the county" that we were "raised" on. We remember that in the autumn when the chestnut leaves began to fall, the water from this spring assumed the color of aniline dye and in the summer after a hard thunder shower it was about the color of Campbell's tomato soup, to say nothing of the relative positions of the barn and other essential outhouses, with respect to the spring.

Today, the discovery that such a spring constituted the source of a public water supply, would make the Pearl Harbor attack seem like a social at the Old Ladies Home, by comparison. It would probably be decided at a mass meeting, whether to make us the "honor guest" at a public hanging or allow us the decency of an open hearing before the "exec" committee.

Solving One of Our Present-Day Aesthetic Problems

Now let's consider one of our present day æsthetic problems, one that is more hypochondriacal than physiological — that of "keeping fresh water fresh" in small distribution storage. A well built up residential section, with a house on every 50 foot lot used to be quite the thing but now we speak of this as "congestion" and we have come to dislike congestion. We are stretching out into the suburbs and we want the water distribution system to follow us. Incidently this "stretching out" process is playing havoc with the old rate bases that were developed on the theory of a house on each 50 foot lot, requiring a corresponding small number of feet of main per customer. We are not only migrating to the wide open spaces, we are also becoming increasingly lofty where undulating topography invites and permits construction of homes. And, we want the water to run up the hill to us. Moreover, we do not have any realization that it costs the water utility more to have it do so. It is not un-

common now for a city to have three to eight different pressure zones.

First we just want water for bare necessities, any kind of water, just so it doesn't cost much. After a few years of growth, the lawyer, banker, doctor or maybe even an engineer in the neighborhood mentions casually at a bridge party, while waiting for refreshments to be served, "If we had fire protection, we could save an 'awful lot' on our fire insurance premiums." That lets the cat out of the bag. A Committee is formed and within two or three weeks we are "waited on" by the committee. "They didn't know it would cost so much to lay larger mains, construct a tank and install a larger pump just to serve their section," but after several more weeks, plans are worked out, financial arrangements are made and an agreement is signed.

The system designed to satisfy the fire protection demands may require storage sufficient for from five to ten days normal domestic usage. A combination of conditions, especially during periods of high temperatures, may require some means of keeping this relatively large quantity of tanked water physically, chemically and savorly attractive to the most discriminating, even though frequent pumping is practiced.

Considerable has been done toward the assurance of the sterility of water drawn from large distribution storage, by the application of chlorine with equipment that operates automatically during only *one* direction of flow—that *from* the reservoir but not into it—this treatment being in addition to the customary chlorination at the source of supply. Several such installations have already been put into service, notably at Baltimore, Md. This is very proper when there is a need for it but what can be done for the smaller plants where the problem is not bacteriological but that of courting three of the five senses—sight, taste and smell? The average impecunious small plant cannot afford an unusual cash outlay if there is a more economical or less expensive means to the same end.

With an increase in the number of small plants and booster systems to serve adjacent surburban territory, much thought is being given to conditioning processes and many ingenious methods have been devised and instituted, inexpensively, by using the "talents" already possessed, as for instance, "Iron Removal" by H. E. Lordley (WW&S Jan., 1942).

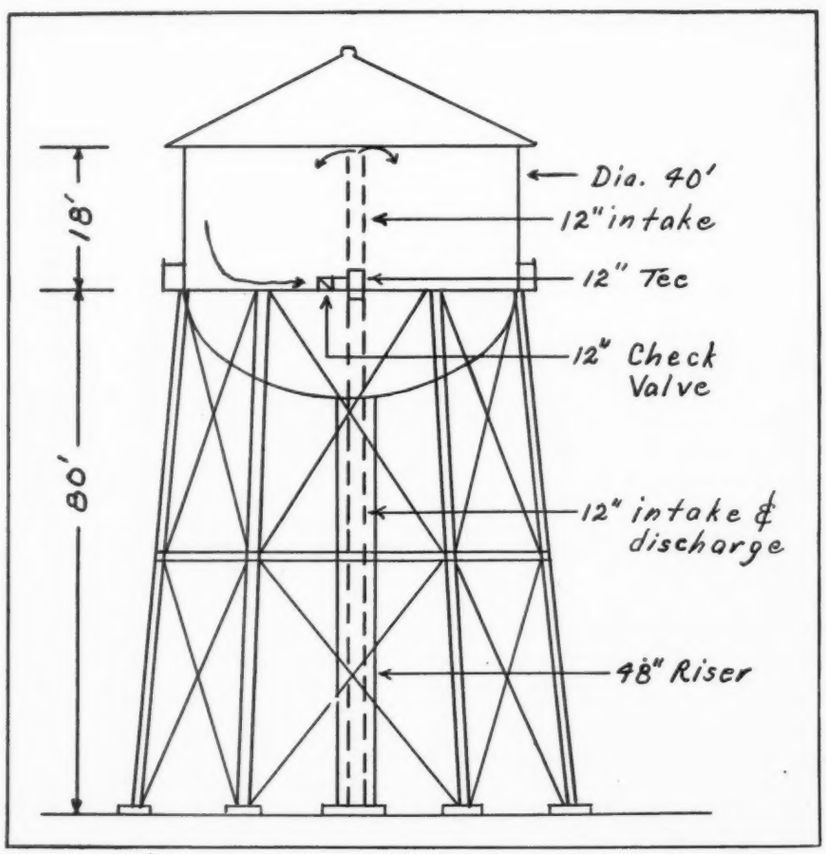
"Keeping Fresh Water Fresh"—One Solution

In one installation with which we are familiar, a 250,000 gallon elevated tank was necessary to adequately satisfy the demands for fire protection, yet this storage was equal to seven days of domestic consumption. Several methods were considered and finally it was decided to try an adaptation of Newton's law of gravity, this being the most inexpensive to operate and the most dependable and with less likelihood of this law being repealed or amended.

As shown in the accompanying sketch, a 12-inch inlet was installed inside the 48-inch riser to a point slightly above the overflow or full point of the tank. In this 12-inch inlet pipe, at a point near the bottom of the tank, a 12-inch by 12-inch tee was installed and a 12-inch horizontal swing check valve was attached to the side outlet of the tee, installed to close when water is being pumped into the tank. This causes the water to overflow from the top of the inlet pipe. When the draught is from the tank the check opens and bottom draft occurs. In addition to the circulation afforded by this scheme, it also furnishes some degree of aeration.

A float switch automatically starts the mile distant pump when the water level in the tank drops 2 feet, and stops it when the tank is full. The cycle of operation is about twice in twenty-four hours and the pump runs about three to four hours at each starting. This method has produced the desired results in a most satisfying manner at no cost for operation, unless the slight increase in average pumping head is considered, which in this case, at the prevailing electric power rate, amounts to slightly more than ½-cent per 100,000 gallons, which of course is negligible.

This method is adaptable to any kind of small elevated or ground storage. We also know of such an installation, in a nearby plant, that is being used in a square concrete reservoir. In this case laterals were extended to each corner of the reservoir, each equipped with a check valve at its end.



250,000 Gal. Elevated Tank Equipped for Keeping Fresh Water Fresh

The influent water is aerated by the spill from the inlet riser. Effective displacement is secured by the take-off through the check equipped bottom tee.

OPERATOR TRAINING SERVICE GOES WITH "CHICAGO" - EQUIPPED ACTIVATED SLUDGE PLANTS IN WAR SERVICE

APPLICATION of "Chicago" equipment is based on Activated Sludge data compiled by the Chicago Pump Company over a period of 10 years of constant research and development operations, both in the laboratory and in the field, and actual operation records of over a hundred existing "Chicago" installations.

INSTALLATION of equipment is under the supervision of experienced Chicago Pump Company Erection Engineers.

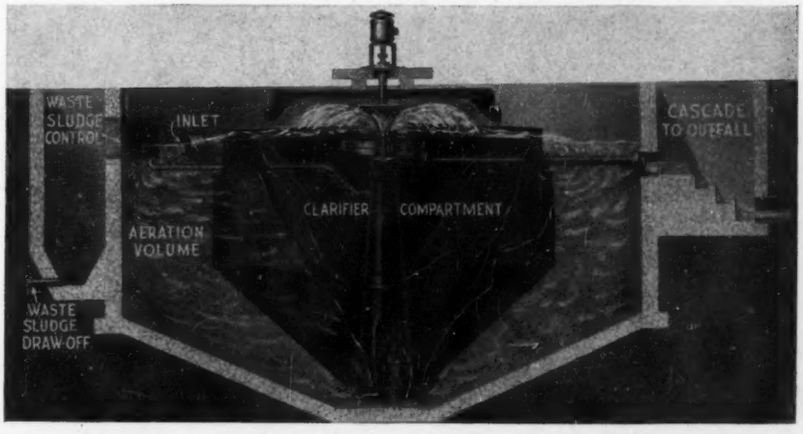
OPERATOR TRAINING SERVICE by our Operating Sanitary Engineers with definite knowledge of process control and plant regulation, BASED ON 10 YEARS EXPERIENCE, trains plant operators to produce a consistently high degree of purification under widely varying sewage flows and strengths.

This is no time to experiment with unproven sewage treatment processes and untried equipment.

SPECIFY TIME-PROVEN ACTIVATED SLUDGE PROCESS WITH "CHICAGO" EQUIPMENT AND OPERATOR TRAINING SERVICE.

Swing Diffusers for Medium and Large Plants.

Stationary Diffusers for Medium and Large Plants.



Combination Aerator-Clarifier for Housing Projects and Small Camps.

SEND FOR LITERATURE ON THE ACTIVATED SLUDGE PROCESS

141
SUCCESSFUL "CHICAGO" EQUIPPED ACTIVATED SLUDGE PLANTS SINCE 1936
Prove the Efficiency of the Process with Rationally Applied "CHICAGO" Equipment and Operator Training Service

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REPRESENTATIVES THROUGHOUT THE UNITED STATES AND FOREIGN COUNTRIES

Relocated 36-inch cast iron pipe at Reading, Pa.

READING, PA. wanted the new highway even if it meant abandoning a seven-mile-long water main which had to be re-routed. The cost of a new cast iron line would have been approximately $350,000.

Fortunately, the original line was cast iron. It could be salvaged and re-used. It was. Seven miles of 30- to 40-year old cast iron pipe in 24-inch, 30-inch and 36-inch diameters were taken up, reconditioned and relocated. The taxpayers of thrifty Reading were thereby saved a large amount of money. This is a striking example of the salvage and re-use value of cast iron pipe. But there are numerous other examples in the files of the Cast Iron Pipe Research Association.

It is impossible to foretell future requirements or population shifts in metropolitan cities but any public official can be sure that, when water or sewer mains must be abandoned or re-routed, the pipe can be salvaged or re-used, *if it is cast iron pipe.*

Pipe bearing this mark is cast iron pipe.

TRADE MARK REG.

Available in diameters from 1¼ to 84 inches.

CAST IRON PIPE RESEARCH ASSOCIATION, THOMAS F. WOLFE, RESEARCH ENGINEER, 1015 PEOPLES GAS BUILDING, CHICAGO, ILLINOIS

CAST IRON PIPE

DRY BRAIDED FIBREX*

Used Like Braided Jute
Will Not Breed Bacteria

Sanitary

PACKING USED IN JOINTING BELL AND SPIGOT PIPE FOR WATER MAINS SEWER MAINS AND SOIL PIPE

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ *FIBREX
PAT. APPLIED FOR

FIBREX is a paper packing treated with a special water repellent, which keeps the FIBREX sterile and prevents it from disintegrating. It has a hard twisted core with a basket weave covering, and packs in a joint exactly the same as dry braided jute.

FIBREX is lighter in weight than jute and only 70% of the usual number of pounds is required. The cost per pound is approximately the same for both FIBREX and jute; resultant savings in using FIBREX are approximately 30%.

FIBREX is shipped in 35 pound reels, and comes in 3/8", 1/2" and 5/8".

FIBREX is a superior packing and already hundreds of pounds are in service on water lines throughout the country. It has the approval of the War Department at Washington, Area Engineer Offices of the War Department, State Departments of Public Health and numerous Water Departments.

★ *Protect your Mains—Use a Sanitary Packing* ★

See page 96 for the complete story on Hydro-Tite—the dependable self-caulking compound.

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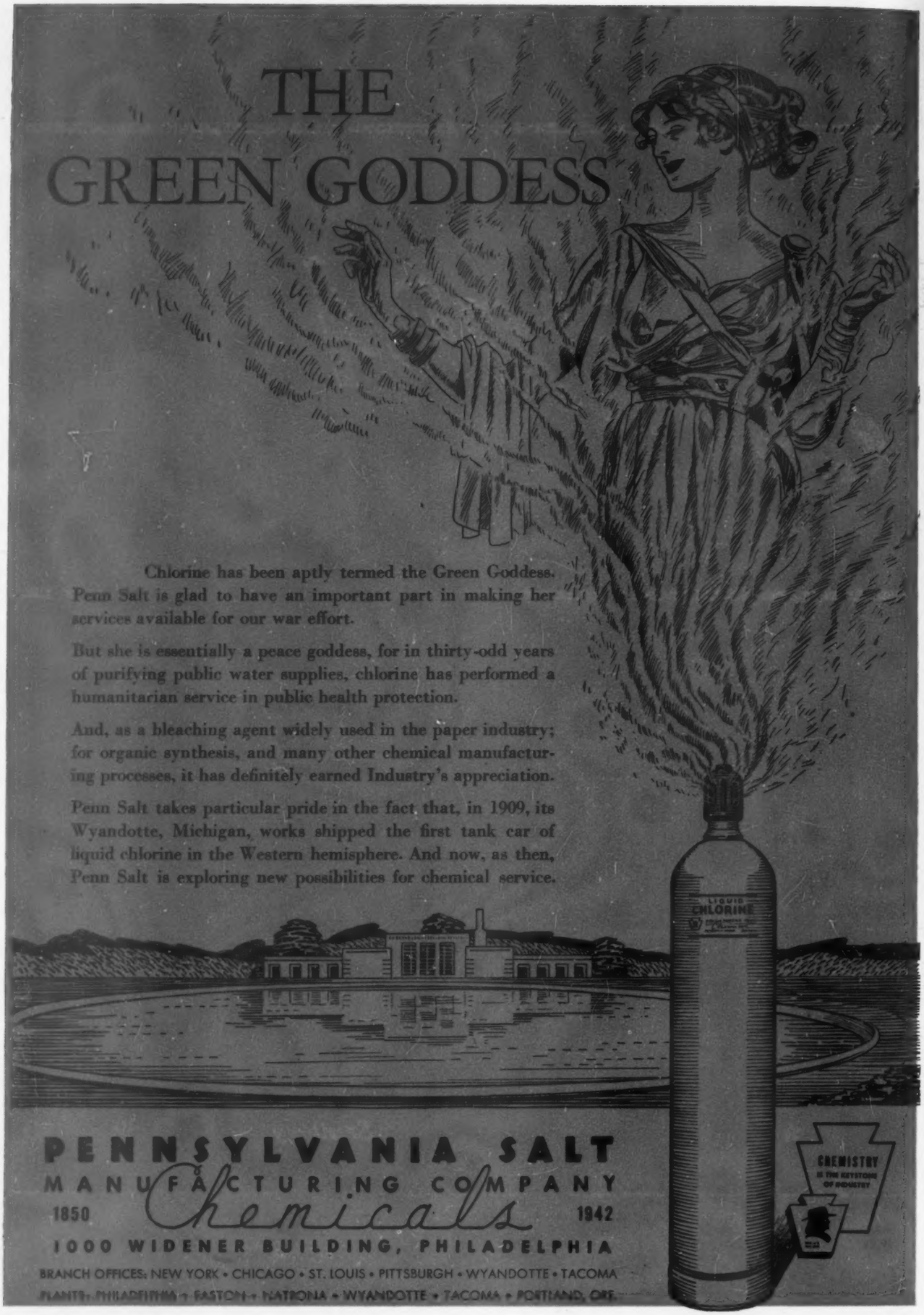
THE
GREEN GODDESS
Chlorine has been aptly termed the Green Goddess. Penn Salt is glad to have an important part in making her services available for our war effort.
But she is essentially a peace goddess, for in thirty-odd years of purifying public water supplies, chlorine has performed a humanitarian service in public health protection.
And, as a bleaching agent widely used in the paper industry; for organic synthesis, and many other chemical manufacturing processes, it has definitely earned Industry's appreciation.
Penn Salt takes particular pride in the fact that, in 1909, its Wyandotte, Michigan, works shipped the first tank car of liquid chlorine in the Western hemisphere. And now, as then, Penn Salt is exploring new possibilities for chemical service.
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CHEMISTRY IS THE KEYSTONE OF INDUSTRY

A.W.W.A.'s WARTIME CONFERENCE

A Report of the Water Purification Division Sessions

By HARRY A. FABER*
Associate Editor

AS PART of the American Water Works Conference on Wartime Water Works Problems in Chicago from June 21st to 25th, the Water Purification Divison held three separate technical sessions. One session was devoted largely to consideration of residual chlorine and bacteriological quality, one to corrosion problems, and another to algae and weed control methods.

The Division luncheon was of timely importance, being followed by a panel discussion on "Problems of Water Supply Quality in Wartime." Nationally recognized authorities, in both military and civilian capacities, discussed various phases of this problem. Since much of the information presented was confidential in nature, attendance at this luncheon was limited to U. S. citizens regularly registered at the conference, and publication of the detailed data is not permitted.

The continued and uninterrupted production of the best possible water for domestic as well as for industrial use is a vital contribution to the war effort. It is this contribution that members of the Water Purification Division are best fitted to make and, as evidenced by the tenor of these sessions, can be counted upon to make. Obviously, the program of this Wartime Conference was planned to accomplish that very result.

*Research Chemist, The Chlorine Institute, Inc., New York, N. Y.

New Officers

To head the Water Purification Division for the coming year, the following officers were elected:

Chairman

Marsden C. Smith, Chief Engineer, Dept. of Public Utilities, Richmond, Va.

Vice-Chairman

A. Clinton Decker, Sanitary Engineer, Tennessee Coal, Iron, and Railroad Co., Birmingham, Ala.

Secretary

Charles R. Cox, Chief, Bureau of Water Supply, Div. of Sanitation, State Dept. of Health, Albany, N.Y.

Past Chairman

Mathew M. Braidech, Professor of Industrial and Sanitary Chemistry, Case School of Applied Science, Cleveland, Ohio.

Members of Executive Committee

George J. Turre, Sanitary Engineer, Water Department, Denver, Colo.

William U. Gallaher, Supt. of Water, Appleton, Wis.

Technical Papers

"The Manipulation and Identification of Micro-organisms" — by James B. Lackey, U. S. Public Health Service, Stream Pollution Investigations, Cincinnati, O.

While there are more than 50,000 species of animal and plant forms which may be found in natural waters, and while 75 to 100 species may be observed at times in a single one milliliter sample, identification of only the common and abundant forms is necessary. For the purification plant chemist or engineer who does only occasional work with the microscope, Mr. Lackey's paper provided abundant suggestions.

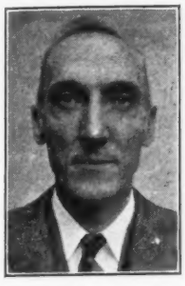
New methods of sampling and especially of preparing samples by preservation with formalin were of special interest. Dip samples may be centrifuged to concentrate organisms without destroying fragile types. Chemists, to whom this is not second nature, must learn how to make a good wet mount.

If the observer is able to identify about 200 species of micro-organisms, this knowledge will serve most general purposes. Usually only four groups—protozoa, rotifera, algae, and bacteria—are of interest. When the problem goes beyond such needs it is time to consult a specialist.

"Control of Micro-organisms"— by L. F. Warrick, State Sanitary Engineer; F. J. McKee, Assistant Sanitary Engineer; and W. Van Horn, Assistant Biologist, State Board of Health, Madison, Wis.

The senior author, in presenting this paper, discussed the development of public interest in the problem of restoring water courses to their pristine quality. Pollution control agencies, local, state, and federal authorities, all are concerned with the problem. Mr. Warrick described the economic losses caused by super-abundant growths

Purification Division Officers



New Chairman
Marsden C. Smith
Richmond, Va.

Post-Chairman
Mat. M. Braidech
Cleveland, O.

Vice-Chairman
A. C. Decker
Birmingham, Ala.

Secretary
Chas. R. Cox
Albany, N. Y.

M'br. Exec. Comm.
Wm. V. Gallaher
Appleton, Wis.

of algae; means of algae control and, particularly, studies made in Wisconsin.

Under certain conditions, even yet not well understood, algae grow with great rapidity. Their extensive development creates an unsightly appearance and offensive odor conditions which seriously reduce the appeal of lakes to summer visitors. Such conditions may cause an economic loss through reduced summer business or through interference with industrial processes.

Weeds can be removed either by cutting or dredging — the latter generally being more lasting. Neither method affects algae. Chemical treatment is required and

Lou. F. Warrick
Chief Engineer
Wis. Dept. Health
Madison, Wis.

Paul Hansen
Consulting Engr.
Greeley Hansen
Chicago

several methods of applying copper sulfate have been found effective. Early studies by the U. S. Dept. of Agriculture and by the Massachusetts Dept. of Health were cited. The early procedure of dragging bags of copper sulfate near the surface has generally been supplanted by more efficient methods. Criticism of chemical treatment has been caused by unequal or exaggerated dosage which kills fish. After completion of elaborate studies, which are under way this summer, it should be possible to provide detailed data on such new control chemicals as sodium arsenite and "Benochlor" compounds used in weed control.

Control of swimmer's itch (which is a considerable nuisance in a few lakes) is another subject under study. This is caused by a parasite, Cercaria, existing as the larval stage in snails and with the adult worms in water birds. The Wisconsin Legislature has sponsored a committee to carry on research studies toward prevention of damage to fish and fish foods. Work already accomplished has proven such research to be a valuable investment.

Extended discussion following this paper indicated the need for a great deal more basic information in this field, especially with reference to conditions affecting algae growth and the application of chemical treatment.

"Traveling Laboratory Control of Bottlers Operation" — by Bert Wells, Chemist, Chemical Control Dept., The Coca-Cola Co., Atlanta, Ga.

There are chemical, physical, and bacteriological requirements of water to be used for production of bottled beverages which differ from the requirements of a municipal supply. The volatile substances in syrups are highly susceptible to reactions with dissolved materials in water. Consequently, many bottlers of Coca-Cola have installed various types of water treatment equipment as protection against contingencies such as: Reduction of tartness by excessive alkalinity, foreign tastes due to mineral matter or chlorine reaction products, sedimentation from presence of algae or slime organisms.

Dependent upon conditions requiring correction, the water treatment equipment may include several or all of the following: coagulating, settling, or alkalinity adjustment devices; sand filters and activated carbon filters; chlorination equipment. Bottlers are careful to point out to plant visitors, however, that the treatment required is due to their special requirements and constitutes no reflection on the wholesome quality of the municipal supply.

The research division of the parent company has designed trailer laboratories for assisting in quality control at bottling plants. A staff of a chemist and technician is thus provided with specially selected water testing equipment (chemical, physical, and bacteriological) and spends one day, or as much longer as may be required by special problems, at each bottling plant. Local personnel is instructed in operation and in the principles of good sanitary practice. The excellent planning and utility of such traveling laboratories (of which a considerable number are in operation) was apparent from the description given by Mr. Wells.

"Specifications for Filtering Material: Committee Report"—by Paul Hansen, Chairman, Greeley and Hansen, Chicago, Ill.

Mr. Hansen summarized the divergence of opinion and the points of view which must be considered by this committee. First: Should there be any standards? Do standards advance or retard progress in new directions? Second: What about standard methods of analysis? There are objections to the use of seives calibrated by the Hazen method and to those designated by manufacturers. Should a standard testing laboratory be designated by the A.W.W.A. for such work? Third: Would it be desirable to include more specific tests such as hardness, shape of particles, etc., or does this have little effect in actual practice?

Some comment indicates that the committee has placed too great emphasis on sand, but Mr. Hansen made it clear that there is no aversion to accepting coal as a filtering material. Further discussion and

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Supt. Filtration
Ind. Water Co.
Indianapolis

Maj. Max. Levine
Station Hospital
Ft. Sam Houston
Texas

revision is to be permitted before final specifications are written.

Chlorination and Water Quality

"Methods for Determination of Residual Chlorine: A Committee Report"—by C. K. Calvert, Chairman, Supt. of Purification, Indianapolis Water Co., Indianapolis, Ind.

Mr. Calvert described briefly the new methods of chlorine determination and of chlorination control which have been designed to those now given in Standard Methods for the Analysis of Water and Sewage. Instead of giving the methods in detail, the report presented reasons for the changes proposed and showed how they differed from current methods.

It has been found that the proper pH of a solution of chlorine in contact with ortho-tolidin should be 1.8 or less in order to obtain uniform yellow colors. The committee recommends use of an ortho-tolidin solution prepared with 200 ml. of concentrated hydrochloric acid per liter instead of the present 100 ml. of acid in order to assure sufficiently low pH. Due to the impurities present in ortho-tolidin, even when that salt has a melting point of 129° C., it will be recom-

mended that ortho-tolidin dihydrochloride be employed. This is commercially available in a high degree of purity, is soluble in water without addition of acid.

Clear yellow colors can be reproduced, even with high chlorine residuals, when a minimum ratio of ortho-tolidin to chlorine of 3 to 1 is maintained. By use of high acid content ortho-tolidin and by specifying the ratio of the reagent, this method becomes equally applicable to water, sewage, and industrial wastes.

Iodimetric methods of chlorine determination are brought from the appendix to the main body of Standard Methods. The neutral

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Asst. San. Engr.
Water Dept.
Houston, Tex.

A. R. Todd
Supt. Filtration
Water Dept.
Wheeling, W. Va.

starch iodide method is especially applicable when interfering substances are present; when an acid titration is employed, acetic or sulfuric acid should be specified rather than hydrochloric. Determination of free chlorine and of combined chlorine by means of the "Titrometer," described by Marks of Wallace and Tiernan Co. (this Marks paper has since been published in the A.W.W.A. Journal, August, 1942 — H.A.F.), provides the only accurate means of measurement. This instrument is expensive and hardly applicable for use in the small water plant but is valuable for use in the large plant and for research.

For measurement of chlorine residuals above 10 ppm. the "Drop Dilution Method" will give results sufficiently accurate for such high residuals. This test will be described and the necessary calculations will be shown. As a method of reliably indicating the presence of free chlorine, the Laux flash test is recommended. It depends upon observation of instantaneously developed color upon the addition of ortho-tolidin reagent to water.

Break-point chlorination and the determination of chlorine demand will be given detailed treatment as new additions to control methods in water treatment. It was pointed out that these methods are probably not final, but will require further revision. The committee believes, however, that they provide a marked improvement over present standard methods.

"Chlorine Residual and Bacteriological Quality" — by Major Max Levine, Station Hospital, Fort Sam Houston, Texas; Austin Heller and Richard Bender, Dept. of Bacteriology, Iowa State College, Ames, Iowa.

In presenting this paper, the senior author explained the title as descriptive of research toward learning whether a certain chlorine residual may be depended upon to insure water of known bacteriological quality. The study is an extensive one and brief review of the paper is impractical.

Methods of determining residual chlorine were compared, over a wide range of doses up to and beyond the break-point. Results of this part of the study clearly indicated the need for differentiation between free chlorine and that combined with nitrogenous matter.

An extensive series of samples was examined (under the sponsorship of Wallace and Tiernan) from four Great Lakes cities. The types of treatment represented ranged from simple chlorination to complete treatment. Samples were taken for immediate examination—with and without dechlorination—and others were stored before being examined to simulate conditions existing in distribution systems. Data obtained indicates the hazard of shipped samples, the coliform index being abnormally lowered in such samples.

Types of organisms resistant to usual chlorine doses were isolated and yielded 177 strains. Of these 61% were aerobacter, 19% were citrobacter, and 20% were escherichia types. The largest single strain isolated (111 types) was pseudomonas, and the incidence of all chromogenic forms was high. Presence of this latter type in water which is to be used for food processing is especially undesirable.

In summary, Major Levine pointed out that the coli index is likely to be lower in shipped samples than in those examined immediately, even when samples are dechlorinated. Certain non-conforming gas forming types of organisms were resistant to chlorine residuals as high as 0.6 to 0.8 ppm. Stipulation of a universally applicable chlorine residual does not seem feasible, though a residual of 0.3 to 0.4 beyond the break-point now seems a safe recommendation.

Extended discussion following presentation of this paper indicated general recognition of the problem. *Norman J. Howard* (Toronto) commented on the puzzling situation created by obscure epidemics in communities where water of recognized standards enters the distribution system. The issues raised by this study should stimulate further research. *H. H. Gerstein* (Chicago) asked for distinction as to whether or not organisms living in water treated with chlorine or chlorine and ammonia are chlorine resistant or are protected from the action of the disinfectant. *Major Levine* replied

Harry A. Faber
Research Chemist
The Chlorine Inst.
New York

Edw. W. Moore
Asso. Professor
Harvard Univ.
Cambridge, Mass.

that pure cultures of coliform organisms are not resistant to sizable chlorine residuals, but that pseudomonas and chromogenic bacteria are.

"Maintenance of Chlorine Residual in the Distribution System"—a group of papers discussing experience in plant operation using superchlorination doses.

Houston, Texas—Clyde R. Harvill, Sanitary Engineer, Water Department.

Mr. Harvill's paper was read by J. H. Morgan, Assistant San. Engineer of the Houston Water Department. Prior to 1929 the Houston supply, from six interconnected systems supplied by wells and reservoirs, required no treatment. When wells were inundated in June of that year chlorination was started immediately. Accumulation of organic deposits — hydrocarbon compounds similar to mercaptans—was responsible for gradually aggravated taste conditions. Chlorine-ammonia treatment was adopted, and gave a measure of taste control. But as higher residuals were required, and as these could not be carried without causing tastes, the situation again required improvement.

The final solution has been chlorination with a 2 to 3 ppm. dose (which provides 1.3 to 1.7 ppm.

residual) as the water is pumped, then the addition of a small dose of ammonia as a dichlorinating agent. The ammonia is added in a ratio of 1 to 7.6 of chlorine to be removed (thus creating an induced break-point) and the water leaves reservoirs with a chlorine residual of 0.3 to 0.8 ppm. which is maintained in the system. While violent by-product tastes were first created by this treatment, and consumer complaints were numerous, conditions have rapidly improved. For the first time successful control of these resistant "crenoform" taste producing organisms has been made practical.

Chas. P. Hoover
Supt. Filtration and Consultant
Columbus, O.

Dr. Frank E. Hale
Director of Labs.
Dept. Water Supply
New York

Boonville, Mo.—Major C. Hagar, Superintendent, Water Department.

Since construction of a new filtration plant to treat Missouri River water, provision of adequately disinfected finished water has been a difficult job. Mr. Hagar recited long attempts to accomplish this by prechlorination, postchlorination, ammonia-chlorine treatment, and by combinations of these methods. Total bacteriological counts were still undesirably high, and a high percentage of positive presumptive tests was obtained. Even when finished water leaving the plant was of apparently satisfactory quality, objectionable conditions would develop in the distribution system.

Since 1939 prechlorination dosage has been increased until the water is super-chlorinated (the Missouri River water shows no break-point). A dose of 5 to 8 ppm. now provides residual chlorine in the system as high as 2.0 ppm. Counts averaging 3 organisms per ml. and some positive presumptive tests are still obtained, but no gas formers give confirmed tests.

Systematic flushing of all dead ends of the system has been of benefit and close control must be maintained to prevent tastes. There are now no consumer complaints, despite the high residual, though a slight odor is present in hot water.

Wheeling, W. Va. — Arthur R. Todd, Chemist, Wheeling Water Department.

Experience at Wheeling, where the heavily polluted Ohio River must be employed as the source of raw water, has led Mr. Todd to the conclusion that complete satisfaction of all chlorine demand is required. When the water no longer has any chlorine demand, and sufficient chlorine is added to provide from 0.5 to 3.0 ppm. residual, the finished water will be stable to a surprising degree. Under this system of treatment and by the usual coagulation and filtration processes, raw water counts of up to 50,000 per ml. are completely eliminated. In 19 months, not a single organism has been found in the finished water by plate counts, nor has a single sample shown gas formers.

The acid river water (pH 3.8) reacts with chlorine for 30 minutes during which iron and manganese are oxidized from the bivalent to trivalent forms, then lime is added to raise the pH to 9.3 and oxidation of organic matter is completed. Average chlorine requirement has been 40 pounds per million gallons in the summer of 1941 and 57 pounds in the summer of 1942; during the winter approximately twice the summer dose is required. Ferrous sulfate already present in the water is thus made to provide the coagulant dosage.

Since the finished water no longer has a chlorine demand, there is little loss of residual even during passage of the water through reservoirs in sunlight. Only when the residual rises above 2.5 ppm. do consumers appear to notice any taste.

These three papers provided material for considerable discussion. *Dr. F. E. Hale* (New York City) expressed surprise that the high residuals described did not cause excessive tastes and *N. J. Howard* (Toronto) raised the question of physiological effect of chlorine in such amounts. *H. A. Faber* (New York City) mentioned a number of supplies treated by superchlorination or break-point chlorination, in which the finished water carried residuals of 1.0 ppm. or more without chlorine taste. Even this amount, while considerably above that present in the average water, is actually a minute quantity of chemical to consume.

John R. Baylis (Chicago) stressed the fact that better water than ever before was provided in each of the three cities. He commended the improvement in bacteriological results and decried the concern over higher chlorine residuals. Complete elimination of all bacteria is more to be desired than extended laboratory work to prove that only harmless types are present, he said. Better tasting and safer water justifies any means of treatment that may be required. *Mr. Todd* cited as evidence of this benefit the fact that Wheeling formerly had an epidemic of gastro-enteritis every fall — until this treatment was adopted.

Chas. R. Cox (Albany, N. Y.) reported that certain municipalities have found an increase of only from 0.6 up to 0.8 ppm. of chlorine dose has produced a stable residual. Several methods of residual chlorine measurement have shown an actual 1.0 to 1.5 ppm. residual to exist in one supply without taste but with a slight odor. Bacteriological results are excellent. A clean distribution system is required for such treatment.

Dan. E. Rupp
Supt. Filtration and Sewage Treat.
Topeka, Kan.

Owen E. Rice
Research Engr.
Hall Laboratories
Pittsburgh

Corrective Treatment Methods

"Conditioning Methods to Inhibit Corrosion: Committee Report"—by E. W. Moore, Chairman, Asst. Prof. of San. Chemistry, Harvard University, Cambridge, Mass.

In a report devoted largely to results obtained through use of hexametaphosphate for control of corrosion, Mr. Moore commented on returns from a questionnaire. From a total of 301 sent, 227 returns were received, with data indicating that 41 per cent of the using municipalities claimed complete correction, 34 per cent reporting partial improvement, 16 per cent noting the application too short to have evidence, and 5 per cent reporting treatment not effective.

Some disturbances of manganese and iron deposits has been caused (sloughing of the distribution system) and higher bacterial counts were obtained in a few instances (apparently due to dispersion of bacterial colonies). Treatment costs are somewhat increased but soap requirements are reduced when meta-

phosphate is substituted for lime. The beneficial effect on non-ferrous metals is not as certain.

Dr. Hale agreed that metaphosphate does hold lime and iron in solution, but pointed out that stopping red water is not stopping corrosion. Laboratory experiments in New York City had indicated greater loss of iron and pitting when metaphosphate treated water was used. *Owen Rice* (Pittsburgh) pointed out that corrosion was also measured by loss of dissolved oxygen, and indicated that large scale tests under normal conditions would often show different results than those obtained in laboratory tests.

"Critical Problems in the Boiler Feedwater Field" — by M. C. Schwartz, Research Associate in Water Technology, Louisiana State University, University, La.

Mr. Schwartz discussed the complex problem of carry-over, important as protection of superheater tubes is required since turbine capacity is reduced by deposits. Complete elimination of carry-over is impossible because some constituents appear truly soluble in steam. Considerable comment was devoted to control of silica deposits and silica removal methods, but the paper must be read in its entirety since the subject is a complex one.

"Stabilization of Lime-Soda Softened Water"—a group of papers devoted to practical experience on this subject.

Chas. P. Hoover, Chemist, Filtration Plant, Columbus, Ohio.

The value of long storage, recarbonation, sand filtration, sludge blanket contact, and metaphosphate treatment for stabilization of soft-

Illinois Hosts

Clarence W. Klassen
Chief Engr.
State Dept. Health
Springfield, Ill.

John R. Baylis
Physical Chemist
Bureau of Water
Chicago

ened water were evaluated by Mr. Hoover. Storage allows slow precipitation of calcium carbonate, while recarbonation converts (at pH 8.3) bicarbonates to normal carbonates. Filtration provides partial stabilization especially if the sand grains are coated with carbonate. Reactions are hastened by contact of softened water with previously precipitated matter and modern equipment has great possibilities. Magnesium should be reduced as far as possible before adding Calgon if maximum efficiency is to result.

Special recommendations were given in this paper for starting operations of new softening plants. In Mr. Hoover's opinion, even more theoretical study of this subject is necessary to further progress in the field of water softening and of stabilization in particular.

Daniel H. Rupp, Water Department, Topeka, Kansas.

Of late years this city has been troubled with milky water (zinc) in long galvanized lines. The precipitation of magnesium and silicate is a function of temperature and heating water up to 140° F. gives no trouble; above this point scale forms. Definite improvement has resulted from the use of metaphosphate, rusty water in dead ends being eliminated and always reappearing when feed of this chemical is stopped. A dose of only 0.25 ppm. is required to prevent scale formation.

Owen Rice, Hall Laboratories, Pittsburgh, Pa.

Attention of water works operators has been primarily devoted to calcium carbonate deposits, but magnasium and silicate are also important (in hot water heaters, not in boilers). As little as one fiftieth ppm. Calgon has a noticeable effect on scale formation in laboratory tests, but too much loss occurs in a distribution system to make such low doses effective.

Mr. Rice noted that storage of softened water did not prevent scale when water was heated. The use of Calgon, rather than additional carbon dioxide, was recommended when excess caustic has already been precipitated by recarbonation. The problem of magnesium silicate deposits has not yet been fully answered.

The use of Calgon cannot be considered an alternative method for recarbonation. A survey made by H. M. Olson indicates that, in 377 municipal lime-soda softening plants, 106 employ recarbonation, 104 use metaphosphates (some in conjunction with recarbonation), and 167 supply unstabilized water (these are mostly small treatment plants). Use of Calgon with surface waters high in dissolved oxygen may not be entirely successful in corrosion prevention.

Lloyd Billings Now in Charge of Sewage as Well as Water Treatment at Dallas

Lloyd C. Billings, who for the past 12 years has been Superintendent of Water Purification at Dallas, Texas, has recently been placed in charge of the Dallas Sewage Treatment Works. His new title is Superintendent and Chief Chemist, Water Purification and Sewage Treatment.

This represents a worthy recognition and salary boost commensurate with the increased responsibilities taken on by Mr. Billings. Also it constitutes another case of the general trend in the direction of continuing water works and sewerage under single management and the advancement in salaries which such combined management makes possible since much duplication of personnel and equipment is avoided in the joint operation and supervision.

Gale Dixon Now Associated with N. Y. Engineering Firm

G. Gale Dixon, who has recently served as Chief Sanitary Engineer for Caribbean Architect-Engineer, in the design of water supply and sew-

G. Gale Dixon

erage facilities for the Army bases in the southern Caribbean area, is now associated with Parsons, Klapp, Brinkerhoff & Douglas, Engineers, of 142 Maiden Lane, New York.

New Technical Dictionary

Chambers Technical Dictionary, edited by C. F. Tweney and L. E. C. Hynes, and published by The MacMillan Co., is said to be the most comprehensive publication of its kind. Among the 50,000 entries are terms used in construction work, pure and applied sciences, mechanical trades, medicine, manufacturing, and water works and sanitary engineering. Many of the definitions are here formulated for the first time. Both English and American terminology are given where they differ. This new dictionary of 957 pages is priced at $5.00, subject to the customary free examination offered by The MacMillan Co., 60 Fifth Ave., New York.

MAINE WATER UTILITIES ASSOCIATION

Holds August Meeting in Camden

A Report by
HORACE L. CLARK
Superintendent and General Manager
SANFORD WATER DISTRICT
SANFORD, MAINE

THE Maine Water Utilities Association met at Camden on August 12, 1942, for its regular bi-monthly meeting. Ordinarily the August meeting is held at one of the more distant towns in Maine, as traveling conditions are usually their best at this time of year. Due to gasoline and rubber shortages the meeting was held at Camden, which is comparatively accessible to all the central and southern part of the state.

In the morning a boat trip on a smooth sea around the harbor was enjoyed by practically all of those in attendance.

Jim Mitchell, Sup't at Lubec, demonstrated some light sections of galvanized steel pipe, 13 gauge, 20 feet long, fitted with carrying handles and self-sealing gaskets. This pipe would be very useful for bridging broken mains in case of air raid damage or for use as emergency water lines.

"Reggie" Hayes, of the Hydraulic Development Corp., passed around samples of the new "Fibrex" Victory Packing for pipe joints made entirely of waterproofed paper. It is claimed that it handles just like good braided jute, but will not harbor bacteria as in the case of jute.

E. J. Prescott demonstrated the Simplex Flexible Pipe Cleaning Rods for services.

Annual Shore Dinner a Feature

The annual shore dinner was served at the Camden Yacht Club at 12:30. During this dinner it was definitely established that Harry Fuller, of Portland, was born in Camden and not in Caribou or some other town in Aroostook County as Dave Moulton (President) and other members of the Association had been led to believe. It was Leo Andrews' birthday and host Allan McAlary, Sup't of the Camden & Rockland Water Co., presented him with a birthday cake. From the size of the cake one would judge that Leo was not more than one year old.

President
David E. Moulton
Atty.
Portland
Water District

Host
Alan F. McAlary
Supt.
Camden-Rockland
Water Co.

Excess Inventory Topic of the Day

After addresses of welcome by Mr. P. R. Keller, Town Manager of Camden, and Mr. Alan Bird, President of the Camden and Rockland Water Co., the meeting got down to the important business of the day. This was in connection with the recapture of materials from Water Utilities having an excess of materials over the inventory on hand Dec. 31, 1940.

President David Moulton reported on the conference held in Boston on August 4 with representatives from the New England Water Association, the New Hampshire Water Works Association, the Connecticut Water Works Association, the Maine Water Utilities Association, the Water Supply Coordinators from Maine, New Hampshire, Massachusetts, Rhode Island and Connecticut and representatives of the United States Public Health Service. At this meeting a resolution was addressed to the acting chief of the power branch of the War Production Board offering the services of the associations in assembling inventories of surplus materials in representative areas in order to make that information available for utilities having work in progress connected with the war effort and for emergency needs of all the utilities.

In this connection, Mr. Moulton stated that insofar as the action of the War Production Board in recapturing these inventories was a criticism of the Water Utilities having excess inventories, he did not feel the association should accept such criticism without protest. "Any water utility that did not foresee the possibilities of a scarcity of material and the possibility of enlarged demand therefor on Dec. 31, 1940, would have been negligent in its duties and unworthy of its trust," Mr. Moulton said.

"Had the utilities as a whole neglected to order additional material for emergency repairs those materials instead of being in storehouses of the utilities would probably have been represented now in unmanufactured pig iron and scrap in the yards of producers," the report continued, and instead of criticism the utilities should be given credit for their foresight.

"The utilities were glad to be in a position to render service for essential war needs such of the ma-

(1) *"Herb" Crowell, New England Manager, Rennselaer Valve Co., Boston.*
(2) *"Spec" Hale, Sanitary Engr., State Dept. of Health, Augusta, Me.*
(3) *Alan McAlary, Supt. (Host), Camden & Rockland Water Co., Camden, Me.; Mrs. Foxwell, Camden Chamber of Commerce; "Sid" Anthony, Supt. (Editor), Augusta Water Distr., Augusta, Me.*
(4) *Maurice Libby, Supt., Bath, Me.; Arthur King, E. & F. King Co.; L. H. Smith, Supt., Kennebunk, Me.; Horace L. Clark, Supt., Sanford, Me.*
(5) *Earl Tarr (Secretary), Supt., Winthrop, Me.; Sam Soule, Supt., Gardiner, Me.; Joe Randlette, Supt., Richmond Water Distr.*
(6) *Randlette—on closer "acquaintance."*

Joe Lufkin, Red-Head Mfg. Co., Boston (Dean of New England "Peddlers")
"Bud" Moore, Neptune Meters, Boston
"Al" Lash, Geo. Caldwell Co., Boston

terial as could be spared, and if the WPB felt any of it is more urgently needed for other purposes, the Maine Utilities would cheerfully cooperate and acquiesce this decision, but it did not take kindly to any intimation that their foresight was subject to criticism."

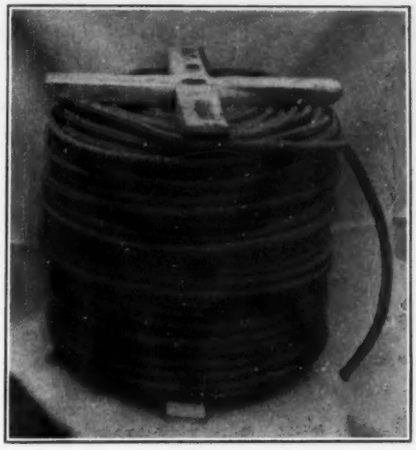
The meeting adopted a resolution for the pooling of information on material surpluses and voted $200 to cover the costs of gathering the information which will go through Howard H. Potter, Waterworks Coordinator for the State of Maine, Augusta, Me.

State W.P.B. Administrator Heard

Mr. E. C. Hyde, State Administrator of the War Production Board, was then introduced. He told those present that it was time to call a halt on expansion. This year may be the critical period of the war and we have got to make the best use of what we have now. The smaller factories should be doing more work and the WPB with that in mind is searching constantly for things for Maine shops to make. Sub and prime contracts in Maine have been increasing especially, and show a very high average on a per capita basis. It is a question now of materials rather than production. This means self-denial on all projects not connected with the war effort. Mr. Hyde then called on Mr. Ralph Ranger, Assistant War Production Board Administrator, who answered a prepared set of questions relative to priorities. Mr. Ranger also told the group that an emergency situation man had been stationed at the WPB office in Boston so that in case of a breakdown of a pump, or other emergency, and materials were not available for repairs, any utility in Maine should call the Portland WPB office. If the value was under $500 the Portland office could get the utility a rating from Boston in order to get the material needed. For repairs costing over $500, a rating must be procured from Washington, but the call must be made through the Portland office, where men serving as expediting engineers can get things done fast.

Mr. Ranger was asked if the comparison of inventories of the present year and for December, 1940, was to be made item for item. He replied that the money value was all that the WPB seemed interested in.

Mr. Ranger was also asked that if a utility continued to have a surplus and the government wished to reclaim some of the material, would it reclaim only the surplus in that material of which the utility had the greatest amount? Mr. Ranger replied that he understood the goverenment would take any material for which there was a definite need, not necessarily that of which there was the greatest amount. Mr. Ranger also spoke of a new PD-1A emergency application which can now be obtained when necessary.



"Fibrex"
The New Victory Packing, samples of which were passed out during the meeting

Horace Cook of Auburn made the report for the Defense Committee which dealt largely with the recapture of materials. He also read a letter from Harry Jordan to A.W.W.A. Section chairmen and secretaries.

The last item on the program was a sound motion picture, "The Construction and Installation of the Stone Canyon Reservoir Supply and Outlet Lines," presented by Mr. Kelly of the Barrett Co. This picture gave a very clear story of the lining and coating of steel pipe.

Acknowledgment—For the snapshots accompanying this report we are indebted to "Reggie" Hayes, of Hydraulic Development Corp.

"Doc" Symons Now "Prof." Symons

George E. Symons (Ph.D), Chief Chemist, Buffalo Sewer Authority has recently been appointed lecturer on the staff of the University of Buffalo. He is officially designated "Lecturer in Hygiene and Public Health," but his lectures are principally on water supply, sewage disposal, swimming pool sanitation and other sanitary engineering phases of municipal sanitation.

A.W.W.A's. President on Special South American Mission

Abel Wolman, President of A.W.W.A., very recently left for South America as a member of the official delegation sent to Brazil by the U. S. State Dept. The delegation is under the chairmanship of Surgeon General Parran of the U. S. Public Health Service. It is understood that this mission to South America is to meet with governmental representatives of most of the Central and South American countries to discuss problems of public health and sanitation in particular relation to the war and post-war reconstruction.

With Apologies to Secretary Gifford

In our July issue we announced the official nominees for offices in the New England Water Works Association. It appears now that we were about to put the long time Secretary of the New Engand Ass'n, out of his job as Secretary and with the job of Treasurer.

With the official ballot there was no indication that the Executive Committee of the Association had decided to combine the offices of Secretary and Treasurer long held separately. Noting that Frank Gifford had been nominated for the Treasurer's job it was an erroneous assumption that he was giving up the Secretary's post.

We have since learned from one of the Vice-Presidents that the two offices are to be combined and Mr. Gifford will be both Secretary and Treasurer from now on. Therefore, NEWWA is not to be faced with the selection of a new Secretary after the forthcoming Annual Meeting, as was indicated seemingly the case.

EVALUATING THE ECONOMY OF HIGHER PUMP EFFICIENCIES

By W. F. SCHAPHORST, ME.
NEWARK, N. J.

THE accompanying chart will be found useful by pumping plant officials, enginers, and mechanics, for determining the savings that are possible by increasing pump efficiencies. This may be accomplished in two ways: by removing the old pump and installing one having higher efficiency, or, by increasing the efficiency of the old pump, if possible.

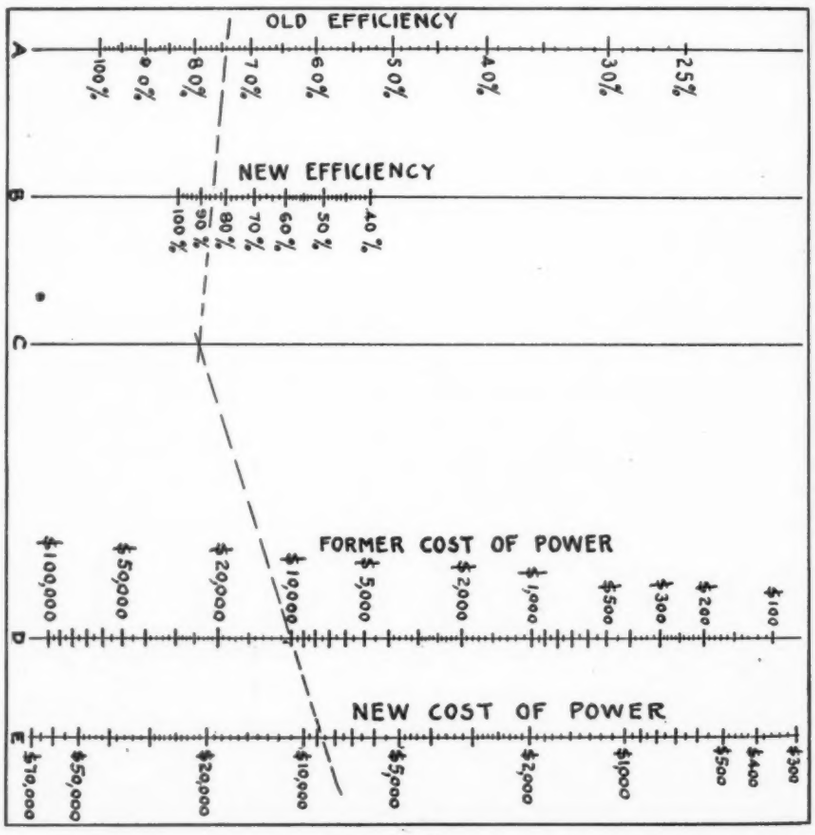
To use the chart, simply zig zag two straight lines across as indicated by the dotted lines and the saving is found by subtracting the figure in column E from that in column D.

For example, let us say that your present pump has an efficiency of 74 per cent and that it is proposed to install a new or improved pump having an efficiency of 85 per cent. The cost of electric power at present is $10,000 per year. How much money will be saved by installing the pump having the higher efficiency.

The dotted lines show how it is done. Run a line through the 74%, column A, and the 85%, column B, and locate the intersection with column C. Then from that point of intersection run through the $10,000 in column D and it will be found that the line cuts column E at $8,700. This means that the new pump will operate at a cost of $8,700 per year for electric power as compared with the present cost of $10,000 per year. Subtracting $8,700 from $10,000 the saving therefore will amount to $1,300 per year.

There is no limit to the range of the chart as regards price or cost. Thus by simply adding ciphers to the figures in columns D and E the same dotted line tells us that if the former cost is $100,000 the new cost will be $87,000. Or if the former cost is $1,000,000 the new cost will be $870,000. And so on. And where the costs are less, simply subtract ciphers. Thus if the former cost is $10 per year three ciphers are removed from the figure in column D and we therefore also remove three ciphers from the figure in column E and the answer is $8.70. In other words, add as many ciphers to the figure in column E as you add to the figure in column D, or, if deducting, subtract as many ciphers from the figure in column E as you deduct from the figure in column D.

The motive behind the chart is to emphasize the money value of higher efficiencies. First cost, of course, must be given consideration as well as efficiency. Thus it may not pay to buy the pump having the highest efficiency **whereas it will pay** well to install a standard pump of reasonable price having an efficiency considerably higher than that of the old pump. The example cited above—74% and 85%—is typical of improvements that are commonly being made at the prsent time, and profitably.



Line Chart Revealing Savings from Improved Pump Efficiencies

TWO-STAGE AERATION

A Recent Development in Activated Sludge Plant Design

By C. A. SCOTT
The American Well Works
AURORA, ILL.

TWO stage aeration is an activated sludge process in which the aeration tanks are in series, or two stages, separated by an intermediate settling tank. The basic form is shown on the accompanying flow sheet.

The primary settling in heavy solids tank is designed on an extremely short detention period. The desire is to remove only that portion of the settleable solids that will come down or float in a few minutes of subsidence. The purpose is two-fold: to hold putrefaction down to a minimum and to allow a small quantity of suspended solids to enter the first stage of aeration.

Combination Bio-Flocculation And Grease Flotation

The primary aeration stage is designed as one-half of the total aeration capacity. Return activated sludge derived from the intermediate settling tank is continuously returned to this unit. This aeration stage is also designed to act as a grease flotation unit. Thus, whenever a large quantity of grease comes to the plant it will be floated and removed in this stage. This will protect the second stage aeration and its activated sludge from harm that otherwise frequently is the cause of a biological upset.

The intermediate settling tank is designed to settle all solids flowing from the first stage and to deliver essentially a solids-free influent to the second stage aeration.

The second stage aeration and the final settling is designed and operated much the same as any standard activated sludge process.

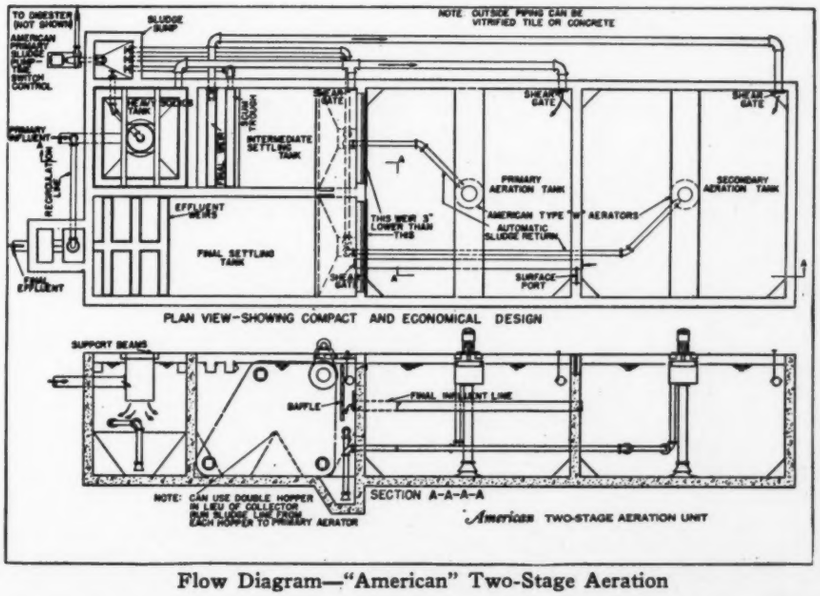
Because the two-stage process is more efficient and less subject to upsets than the standard activated sludge process, the total aeration period can be shortened; or, for equal retention periods, the reliability of the process is much increased. In either event, the electrical energy required to operate the process is materially reduced. Also, the dry weather troubles are abolished when this flow sheet is practiced.

Effluent Recirculation An Important Advantage

Another important development incorporated into this plant layout is the recirculation of large quantities of final plant effluent, carrying dissolved oxygen, if not beneficial activating substances in addition. This recirculation will greatly increase the efficiency of any activated sludge plant and since the two-stage plant is designed to practice effluent recirculation the process is particularly effective.

Two-stage aeration is an evolution or improvement in the older style pre-aeration and grease flotation followed by activated sludge. The improvements are a short detention period ahead of the pre-aeration stage and a return of intermediate settling tank sludge to the pre-aeration stage to act as a nucleum to increase the effectiveness of that unit. Incidentally, it has been often observed that the high efficiency of BOD removal in pre-aeration and grease flotation tanks is not realized until the plant has been in operation for two or three months. This is enough time to allow a fairly good nucleus of suspended solids (amounting to three or four hundred parts per million) to develop in that unit. However, the stage of primary aeration is more effective than the original application of pre-aeration and grease flotation because aerated sludge is returned from the intermediate settling tank to this stage to any extent required. If anything happens to the sludge in the first stage of aeration it will be lost, but the final stage will not be affected. This could occur through the introduction of an abnormal quantity of grease which would cause the sludge to become septic. In a standard activated sludge process, any harmful substances passing through the primary settling tank (such as grease) will immediately exert a detrimental effect on the entire inventory of activated sludge and the whole plant will be adversely affected.

Two-stage aeration represents an advancement in the design of activated sludge plants. This flow sheet, if properly designed, eliminates many of the hazards of former activated sludge operation and allows the application of activated sludge to cases hitherto considered impractical.



Flow Diagram—"American" Two-Stage Aeration

The Editor's Comments

What's Wrong with the Theory?

IN WATER works operation for many years it was considered good practice to aerate water being pumped into distribution systems. Then came the oxygen theory in corrosion to put a damper on aeration. This being on the score that any oxygen added would only add "fuel to the fire" of internal corrosion of pipes, with attendant "red-water" troubles and tuberculation accentuated. Such theory has resulted in a considerable discontinuance of aeration, and advancement of the idea by chemists that the *really* correct practice would be that of de-aeration. In some instances the latter practice has seemingly been the correct procedure in suppressing corrosion of supply mains. In other instances, discontinuance of aeration has resulted in increased consumer complaints coming out of the fact that water from sluggish flow sections of the system took on foul odors and the increased iron content indicated water degradation and advancing corrosion under conditions of such oxygen deficiency—frequently the production of hydrogen sulphide being noted as the result of sulphate splitting, which is always indicative of oxygen depletion and anaerobic conditions. This more objectionable condition had to be rectified by modified or fractional aeration. And then further rectified by chlorination to slow the speed of oxygen depletion believed to be the result of biological activity within the slime film and deposits which naturally accumulate in sluggish flow sections of pipe systems, and in dead end sections in particular.

So it is apparent that while the oxygen theory in corrosion may be the correct theory when dealing with chemical ions and water (only) in a laboratory study, or in boilers, or in any system essentially in a sterile condition, adherence to the oxygen theory falls short of solving cold water corrosion troubles in water supply systems *as they exist*. The principal reason for failure of theory in practice in this instance is the vitiating effects set up by a factor not entering into conditions surrounding the development of the theory. Besides conductivity (ion concentration inducing galvanic activity), the molecular hydrogen blanket, assumed to protect metal against continuing attack, and the dissolved oxygen which combines with the hydrogen of the nebulous film of protection and exposing fresh areas for corrosive attack, a third factor involving biological phenomena is a major and upsetting factor in any "pure theory" that may be applied in water supply practice—i.e., unless this upsetting factor is considered and properly dealt with.

Now we are at the point of this dissertation which has been brought on by the extremely interesting and revealing studies of Dr. Irba Thomas, Chief Research Chemist of American Rolling Mills Co., as reported in his paper elsewhere in this issue. Perhaps the writer is particularly enthused over the findings of Dr. Thomas because they confirm a supposition and explanation advanced on numerous occasions to the effect that the corrosion problems inherent in water distribution should be amenable to correction by any practice which suppresses biological activity within the pipe. In actual practice this supposition has seemingly been shown to be correct and so-called dead end troubles from corrosion, concurrently with oxygen depletion and water quality degradation, have been largely cleared up where it has proved possible to maintain residual chlorine through the pipe system to the sluggish flow fringe sections.

What the Middletown controlled studies disclose are confirmatory of this "biological theory" advanced by the writer in explaining "red-water" and more particularly "black-water" troubles on distribution systems. What was learned is that the iron-monger group of bacteria (crenothrix and the like) and sulphate splitting organisms play havoc with chemical theory in corrosion control. Secondly, that without control of organism growths on pipe walls it is best to have dissolved oxygen present throughout the system. But the eminently practical problem is that of maintaining dissolved oxygen when oxygen depleting growths are demanding it continuously, and having exhausted the "free" oxygen, then turn to breaking down sulphates to produce sulphides and "black-water" from iron attack. From the results at Middletown, referred to by Dr. Thomas as a most "vivid and practical demonstration," the efficacy of biological control with chlorine treatment—particularly with lasting residuals from ammonia-chlorine treatment—is a simple, practical and economical anti-corrosion measure. Since such treatment tends to hold dissolved oxygen in the water—thus "keeping fresh water fresh," as the writer has termed the practice—the method does not fit into the oxygen theory in corrosion suppression. But neither do the observations of Dr. Thomas fit the theory when it is apparent that the most pronounced corrosion resulted from well waters most deficient in dissolved oxygen, and decreased with the introduction of oxygen into the supply. On the other hand, the extent of oxygenation played little part in results observed under conditions approaching sterility—i.e., when residual chlorine maintained the exposed iron free of slime growths and oxygen depleting bacteria.

There is probably nothing wrong with the dissolved oxygen theory as a pure theory—what is wrong is that it plays less of a role in cold water corrosion *within* most closed cold water systems than has been presupposed, and the factor of unappreciated import has been that unequatable factor of biological behavior which varies with food supply, oxygen balance and, *most* pronouncedly, with temperature variations. The latter would indicate the higher importance of aiming for main sterility in summer than in winter—the very time when this attainment becomes the most difficult in practice.

L. H. Enslow

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determine necessary extensions and replacements to meet present needs and future requirements over a twenty-five year period. See Bulletin No. 18.

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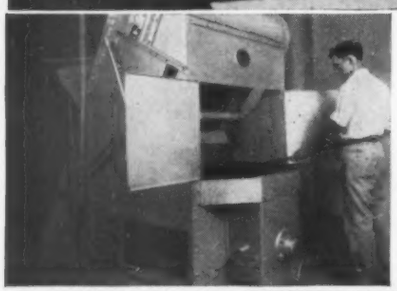
"HERE'S THE PROVED ANSWER TO THAT SCREENINGS DISPOSAL PROBLEM!"

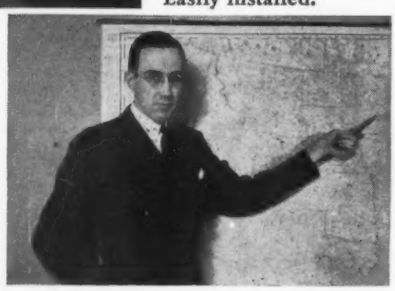


① "IT'S THE REX Triturator—the screenings shredder whose success is based upon its clean-cut shearing action and the thorough disintegration of rags, papers, and other forms of organic solids, permitting their direct return to the sewage flow for subsequent settling and digestion.

② "INSTALLED WITH either new or existing bar racks (hand or mechanically cleaned) the Rex Triturator does its work with very low water and electric current consumption. Triturated screenings are uniformly minute—no stringy or large pieces of material are allowed to go through.

③ "CATALOG NO. 289 gives you all the specifications and other details—tells of the Triturator's sturdy construction, its accurate balance with corresponding minimum vibration, its minimum power requirements against maximum screening capacity. Easily installed.

④ "FROM COAST TO coast, under all conditions, the Triturator has proved itself through its lower installation cost, its lower operating cost, low cost for flushing water. If you want to save money—and do a good job—it's the right answer!"



Bulletin No. 289 and other catalogs on any or all of the Rex Sanitation equipment, including bar screens, sludge collectors, Aero-filters, Slo-mixers are available at your request. 1610 W. Bruce Street, Milwaukee, Wisconsin.

REX TRITURATORS

CHAIN BELT COMPANY OF MILWAUKEE

MEETINGS SCHEDULED

Sept. 15-16—BOSTON, MASS. (Hotel Statler)
New England Water Works Association. Sec'y, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Sept. 17-18—CHEYENNE, WYOMING (Frontier Hotel)
Rocky Mountain Section A.W.W.A. Secretary, B. V. Howe, 201 Argonaut Hotel, Denver, Colo.

Sept. 18—PITTSBURGH, PA. (Roosevelt Hotel)
Western Pennsylvania Section A.W.W.A. Secretary, E. P. Johnson, 418 Flannery Bldg., Sta. 13, Pittsburgh, Pa.

(Joint meeting)

Pennsylvania Water Works Operators Ass'n. Secretary, I. M. Glace, 22 South 22nd Street, Harrisburg, Pa.

Sept. 20-22—LOS ANGELES, CALIF. (Hotel Clark)
California Sewage Works Association. (15th Annual Convention.) Sec'y-Treas., Jack H. Kimball, Orange Co. Health Dept., P. O. Box 355, Santa Ana, Calif.

Sept. 21-23—WILLISTON, N. D. (Great Northern Hotel)
North Dakota Water & Sewage Works Conference. Secretary, K. C. Lauster, Bismarck, N. D.

Sept. 23—SPRINGFIELD, MASS. (Hotel Kimball)
New England Sewage Works Association. (One day Conference.) Sec'y-Treas., LeRoy W. VanKleeck, State Dept. of Health, Hartford, Conn.

Sept. 24-26—ST. PAUL, MINN. (Lowry Hotel)
Minnesota Section A.W.W.A. Secretary, A. M. Finch, Wallace & Tiernan, Inc., 416 Flour Exchange, Minneapolis, Minn.

Sept. 26—LIVINGSTON, N. J. (Doerr's Grove)
New Jersey Sewage Works Association. (4th Annual Outing). Secretary, John R. Downes, Plainfield, N. J.

Sept. 28-29—HURON, S. D. (Marvin Hughitt Hotel)
South Dakota Water & Sewage Works Conference. Secretary, W. W. Towne, State Board of Health, Pierre, S. D.

Oct. 7-9—PHILADELPHIA, PA. (Benjamin Franklin Hotel)

(Joint meeting)

Four States Section A.W.W.A. Secretary, H. Lloyd Nelson, 1624 Lincoln-Liberty Bldg., Philadelphia, Pa.

New Jersey Section A.W.W.A. (Secretary, C. B. Tygert, P. O. Box 178, Newark, N. J.

Pennsylvania Water Works Operators Association. Secretary, I. M. Glace, 22 South 22nd Street, Harrisburg, Pa.

Oct. 12-14—ROCHESTER, N. Y. (Sagamore Hotel)
American Society Mechanical Engineers. Secretary, 29 West 39th Street, New York, N. Y.

Oct. 12-14—LITTLE ROCK, ARK. (Marion Hotel)
Southwestern Section A.W.W.A. Secretary, Lewis A. Quigley, City Water Works, 3320 W. Berry, Fort Worth, Texas. (Conference War Time Problems.)

Oct. 14—WINTHROP, ME.
Maine Water Utilities Association. Secretary, Earle A. Tarr, Winthrop, Me. (Next meeting Dec. 10th, Bangor, Me.)

Oct. 15-16—ALBANY, N. Y. (DeWitt Clinton Hotel)
New York Section A.W.W.A. (War Conference.) Sec'y-Treas., R. K. Blanchard, 50 West 50th St., New York, N. Y.

Oct. 15-16—ATLANTA, GA. (Ga. School of Technology)
Georgia Water and Sewage Association. Secretary, T. T. Gunter, Chief Operator, Pressure Filter Plant, Atlanta, Ga.

Oct. 18-21—CLEVELAND, OHIO (Statler Hotel)
American Public Works Association. (Annual Public Works Congress.) Exec. Dir., Norman Hebden, 1313 East 60th St., Chicago, Ill.

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For wartime emergency-breaks in pipe lines, this Doublex Simplex Split Sleeve will enable you to make quick, economical, effective repairs. You should have a supply of several of each different size that you might need. Thousands in use, some for 13 years. Order now from shipping point nearest you as follows: Birmingham, Dallas, Kansas City, Los Angeles, Minneapolis, San Francisco, Pittsburgh.

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★ pH ★ Color
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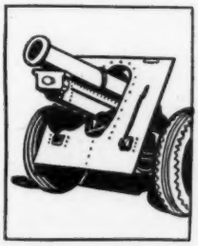

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4 Hill-Hubbell Coating-Wrapping-and-Lining are machine applied only on Steel Pipe, under proper thermostatic control.

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MEETINGS SCHEDULED

Oct. 19-21—PADUCAH, KY. (Irving Cobb Hotel)
Kentucky-Tennessee Section A.W.W.A. Secretary, H. D. Schmidt, Div. San. Eng., State Dept. of Health, Nashville, Tenn.

Oct. 20-21—WAUSAU, WISC. (Hotel Wausau)
Wisconsin Section, A.W.W.A. Secretary, Leon A. Smith, Sup't of Water Works, City Hall, Madison, Wis.

Oct. 21—HARRISBURG, PA. (Penn-Harris Hotel)
Pennsylvania Water Works Association. (Meeting devoted to Wartime Problems.) Secretary, F. Herbert Snow, 22 South 22nd St., Harrisburg, Pa.

Oct. 22-23—TORONTO, ONT. (Royal York Hotel)
Canadian Institute on Sewage and Sanitation. Sec'y-Treas., A. E. Berry, Ontario Department of Health, Parliament Buildings, Toronto, Ont.

Oct. 23-24—ST. LOUIS, MO. (Coronado Hotel)
Missouri Valley Section, A.W.W.A. Sec'y, Earle L. Waterman, 104 Engineering Hall, University of Iowa, Iowa City, Ia.

Oct. 22-24—CLEVELAND, OHIO (Hotel Statler)
Federation Sewage Works Associations. (3rd Annual Convention.) Sec'y, H. W. Wisely, Urbana-Champaign Sanitary District, Urbana, Ill.
(In conjunction with Ohio Conference on Sewage Treatment.)

Oct. 22-24—CLEVELAND, OHIO (Hotel Statler)
Ohio Conference on Sewage Treatment. (Meeting with Federation of Sewage Works Associations). Sec'y-Treas., W. D. Sheets, 568 E. Broad Street, Columbus, Ohio.

Oct. 27-30—ST. LOUIS, MO. (Jefferson & Statler Hotels)
American Public Health Association. Exec.-Sec'y, Dr. Reginald M. Atwater, 50 West 50th St., New York, N. Y.

Oct. 28-30—OAKLAND, CALIF. (Hotel Oakland)
California Section, A.W.W.A. Sec'y, H. Arthur Price, Dept. Water and Power, 316 West 2nd St., Los Angeles, Calif.

Nov. 2-4—DURHAM, N. C. (Washington Duke Hotel)
North Carolina Section, A.W.W.A. Sec'y, R. S. Phillips, Chief Chemist, Water Department, 206 Dacian Ave., Durham, N. C.

(Meeting jointly with)

North Carolina Sewage Works Ass'n. (22nd Annual Meeting). Sec'y-Treas., R. S. Phillips, 206 Dacian Ave., Durham, N. C.

Nov. 5-6—RICHMOND, VA. (Jefferson Hotel)
Virginia Section, A.W.W.A. Secretary, F. H. Miller, Ass't Engr., Bureau of Sanitary Engineering, Dept. of Health, Richmond, Va.

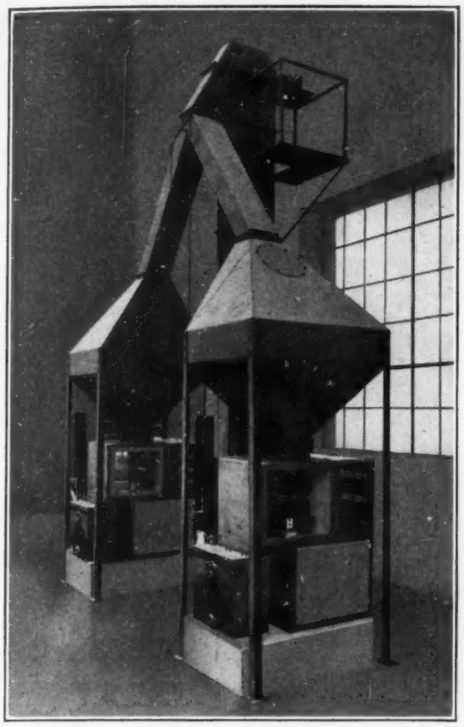
Nov. 9-10—HANNIBAL, MO. (Mark Twain Hotel)
Missouri Water & Sewerage Conference. Sec'y-Treas., W. A. Kramer, State Board of Health, Jefferson City, Mo.

Nov. 9-10—PITTSBURGH, PA. (Wm. Penn Hotel)
3rd Annual Water Conference. Sponsored by Engineers' Society of Western Pennsylvania. H. M. Olson, Conference Chairman, 171 Longuevue Drive, Pittsburgh, Pa.

Nov. 12-13—PARKERSBURG, W. VA.
West Virginia Section A.W.W.A. Secretary, J. B. Harrington, Director, Division of Sanitary Engineering, Department of Health, Charleston, W. Va.

Nov. 12-14—MIAMI, FLA.
Florida Section, A.W.W.A. Secretary, A. P. Black, Prof. of Agricultural Chemistry, University of Florida, Gainesville, Fla.

"The Last Word in Chemical Feeders"



OMEGA Combined Elevators, Feeders and Dust Removers are saving construction and chemical handling costs in many plants.

"Maybe OMEGA has an idea about how to do it" is a frequently heard remark.

The illustration shows two OMEGA Belt Type Gravimetric Feeders with combined elevator, storage hoppers and dust remover.

OMEGA MACHINE COMPANY

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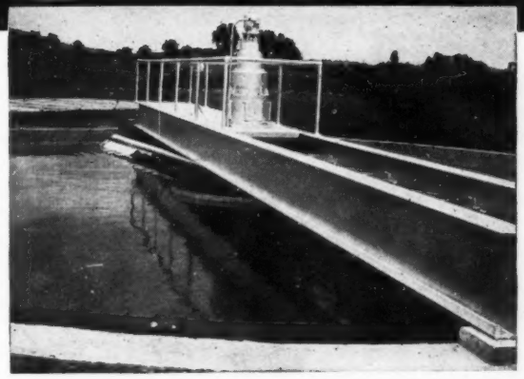

● Infilco Clarifiers are well designed to offer the maximum in efficient performance and are substantially constructed of high grade materials to render a long, trouble-free service life.

● Write for information on the advantages of Infilco Clarifiers for application in the sewage treatment field.

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3 *Money, Time and Labor Saving Features of*

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Laid with Only Wrenches →

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TO THE men in service, it is more than letters from home, chicken dinners on Sunday, U.S.O. dances. It's the sense of well being that comes from pleasant surroundings. Clean barracks, well kept grounds — and that implies lawn and shrub beautification.

Uncle Sam is doing the job right. Army camps, pilot training centers and naval shore establishments are being beautified with park-like surroundings. More than a dozen Royers are preparing sludge for use as lawn top dressing and fertilizer for these government cantonments.

The Royer disintegrates sewage sludge cake from the drying bed, further drying it, aerating it and, where desired, mixes in sweetening and enrichening chemicals such as lime, phosphate and ammonium sulphate. They are doing their part to keep up morale in the best paid, best clothed, best fed fighting force in the world.

A Royer Model "SO" helps beautify Camp Edwards. One of 12 electric, gasoline engine and tractor driven portable and stationary models. (Furnished with steel wheels until rubber tires are again available.)

THE ROYER

ROYER FOUNDRY & MACHINE CO.
170 PRINGLE ST., KINGSTON, PA.

LITERATURE AND CATALOGS

"Fibrex"—the New Sanitary Victory Packing was recently announced by Hydraulic Development Corp., producers of "Hydrotite" and "Sani-Tite" compounds. A folder received sets forth the several attributes of this new pipe joint packing, developed to replace bacteria harboring and more expensive jute.

The folder pictures and describes "Fibrex" as the answer to an increasing demand for a joint packing that will not harbor and support trouble making bacterial growths. In this direction a chart revealing the negligible growth of organisms on and within "Fibrex," as contrasted to various specimens of jute packing employed in the comparative growth tests made by a leading laboratory.

"Fibrex" is essentially fibrous paper rope impregnated with a tough water repellant which resists bacterial growth. With a hard, twisted core the strand is covered with a basket-weave jacket, resembling the covering on insulated wires. It is 30% lighter in weight than dry braided jute and comes in 35-lb. reels, which go as far as 50 lbs. of jute. Cost saving is therefore about 30%, since this new sanitary packing is in all respects used just as braided jute would be. When driven up in the joint it stays put.

The "Fibrex" folder reveals sizes ⅜", ½" and ⅝" available—and a table gives the number of pounds required per joint per pipe sizes 3" to 60". It is pointed out that "Fibrex" is applicable in the making of joints with compound, lead or bituminous sewer-jointing compounds —its featured quality, however, being its initial sterility and inability of bacteria to set up "housekeeping" in joints packed with it.

If you find this review interesting you can secure further information and a sample of "Fibrex" from Hydraulic Development Corp., 50 Church St., New York City.

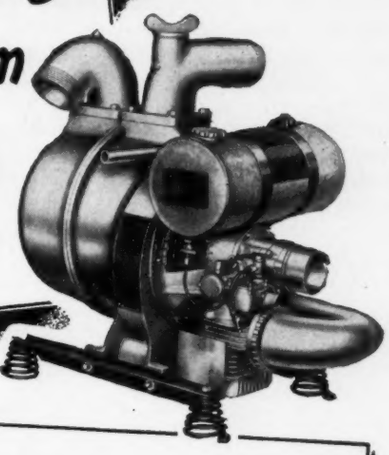
Sewage Equipment by Graver will be news to many who have always associated the name Graver with water equipment only. But "Sewage Equipment" is the subject of a new 8-page bulletin, illustrated with constructional and layout drawings. Trickling filters, clarifiers and digester mechanisms are among the equipment discussed in

detail. The Graver Rotary Distributor, designed for all high rate and low rate trickling filters, may be operated either from a pump or an automatic dosing siphon. The dosing siphon provides a maximum and minimum head on the distributor by discharging a measured amount of liquid between two predetermined water levels. Both arms and center column of the distributor are made of steel. Nozzles spaced along the distributor arms are of a non-clogging type.

Graver Primary Clarifiers are furnished with an automatic skimming device which removes floating matter and discharges it into a scum trough. Among the types of digester equipment are offered "floating covers," which provide integral gas storage for the operation of gas engines and hot water heating systems. Graver also offers to design complete sewage treatment plants. Flow diagrams of two trickling filter systems and one activated sludge system are shown. For a copy of this new "Sewage Equipment" bulletin, Form 311, write to Graver Tank and Manufacturing Co., Inc., East Chicago, Ind.

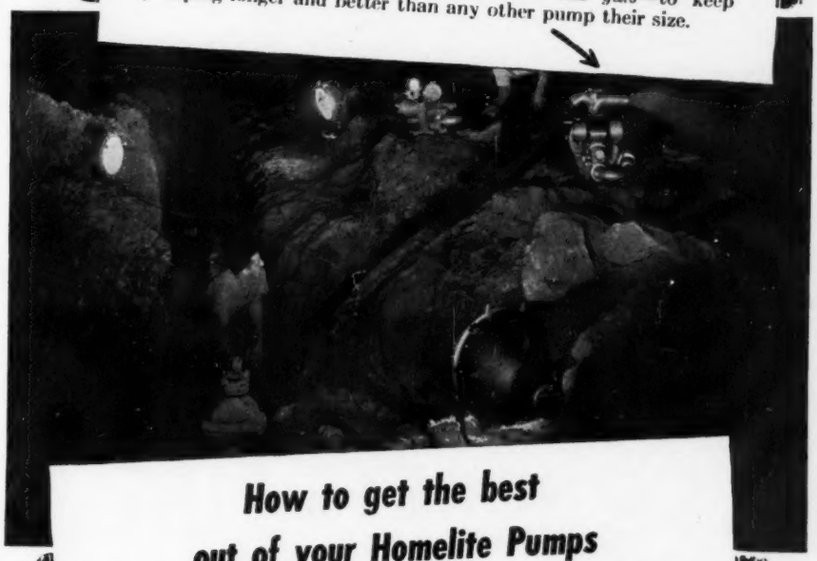
Link-Belt's "Bulk-Flo," combining the functions of conveyor, elevator and feeder, is described and illustrated in a new 32-page catalogue. Two new sizes have been added since the equipment was first announced in June, 1941. "Bulk-Flo" systems are suitable for conveying a large variety of granular, crushed, ground and pulverized materials such as are prevalently employed in water, sewage and industrial waste treatment. Numerous photographs and drawings illustrate some of the typical layout arrangements for different materials. Tables show the ton-per-hour capacities of various models. "Bulk-Flo" conveyors require a minimum of space and are almost self-supporting. The material conveyed occupies almost the entire cross sectional area of the duct. The catalogue contains all pertinent engineering information, power requirement, data and instructions for ordering. Summarized information on Link-Belt's varied line of drives and transmission equipment is also given. To obtain the catalogue, request Book No. 2075 from Link-Belt Co., 300 W. Pershing Road, Chicago, Ill.

It's a good thing we made them **SO GOOD**



They Pump Better and Longer

The Homelite Corporation has always built *quality* into its portable pumps—the best materials, the best workmanship, the best engineering skill. And this extra quality is paying off these days to those who have these Homelite Portable Pumps. With all new Homelites going into the Army, those units now in the field will have to stick it out for the duration. Which they will do. Homelites have the rugged constitution—the *guts*—to keep pumping longer and better than any other pump their size.



How to get the best out of your Homelite Pumps

A Homelite Portable Pump doesn't need any babying, but you should give it a little care. Simple jobs such as putting ¾ pints of oil with each gallon of gasoline in the engine, or keeping the suction hose tight, or keeping spark plugs in good condition, will lengthen the life of your equipment. Why not, *right now*, send for a free service manual that will show you how to take the best of care of your Homelite Pump? When writing for copy, specify model and serial numbers of the Homelite Pumps you now have.

HOMELITE CORPORATION

2509 Riverdale Avenue, Port Chester, New York

Noiseless Shock-Absorbing Check Valves are described in two bulletins recently received from the Smolensky Valve Company. Flanged check valves, as shown in Bulletin No. 11, are in general use on pump discharge lines, serving as a safety factor to protect pumps against static load on high head and to minimize pipe line surge resulting from sudden stoggage of pumps. They are also in use as foot valves. Bulletin No. 9 describes the Smolensky Radialflow (noiseless) Check Valves, designed to eliminate friction loss. The flow through the valve is radial and the passage almost needle point. It is thereby a quick closing valve for precluding water-hammer effects. Both bulletins contain complete tables of dimensions, sizes and prices. For a copy of Bulletin No. 9 or No. 11 write to the Smolensky Valve Company, Cleveland, Ohio.

"What Every Executive Should Know About pH" is the title of a booklet recently released by the National Technical Laboratories. It starts right at foundation level by defining pH. In simple, non-technical language the booklet explains how pH is measured electrically through the utilization of the hydrogen, quinhydrone and antimony electrodes, which, when immersed in a solution, develop voltages in proportion to the hydrogen ion content of the solution. Now a special glass electrode is being widely used for pH measurement. The attribute glass of the electrode is that it can be used anywhere, regardless of color, viscosity, temperature or chemical nature of solutions. The final pages describe and illustrate Beckman pH equipment using glass electrodes. A copy of "What Every Executive Should Know About pH" can be obtained by addressing the National Technical Laboratories, South Pasadena, Calif.

Interesting is the novel 100-Year Calendar received from W. H. Stewart, producer of sewer cleaning and maintenance equipment since 1901. If you have as much curiosity as had this reviewer you will want to see one of these tricky century calendars, which will tell you on what day of the week you were born too many summers ago to want to remember. Likewise it will tell you on what day of the week your golden anniversary or your 99th birthday will come. Strangely enough, though, there are no red letter dates on this calendar to remind one that it's time to de-root or clean those troublesome sewers. To request a copy of this novel calendar the only address needed is W. H. Stewart, Syracuse, N. Y.

"Plain Facts on Wartime Care of Rubber V-Belts" is the title of a new 16-page handbook published by Allis-Chalmers. It begins by explaining how the structure of a V-belt affects its maintenance. Then it proceeds to the story of what determines life-expectancy of V-belts, how to obtain proper tension, and what to do about worn sheaves. Finally, it gives illustrations of seven V-belt injuries, their causes and how such injuries can be prevented. If you have V-belt drives be sure to request a copy of this handbook. Address Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Portsmouth, Va., with a heavy influx of Navy Yard workers, increased its water supply from 6,000,000 to 13,000,000 gallons per day by building a 13-mile water line of 30-in. concrete pipe. Laying crew placed 400 ft. of pipe daily.

Defense-area water and sewerage projects need the durability and economy of

CONCRETE PIPE

Concrete pipe has proved its durability on a vast scale, with installations dating back half a century and more. While conserving critical materials, it fully meets ALL the requirements of moderate first cost, structural safety, minimum infiltration and leakage, and maximum hydraulic capacity.

Technical assistance is available to engineers and builders engaged in vital wartime projects involving concrete pipe or other concrete construction.

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BUY DEFENSE STAMPS AND BONDS... SUPPORT THE RED CROSS

BUY DEFENSE BONDS

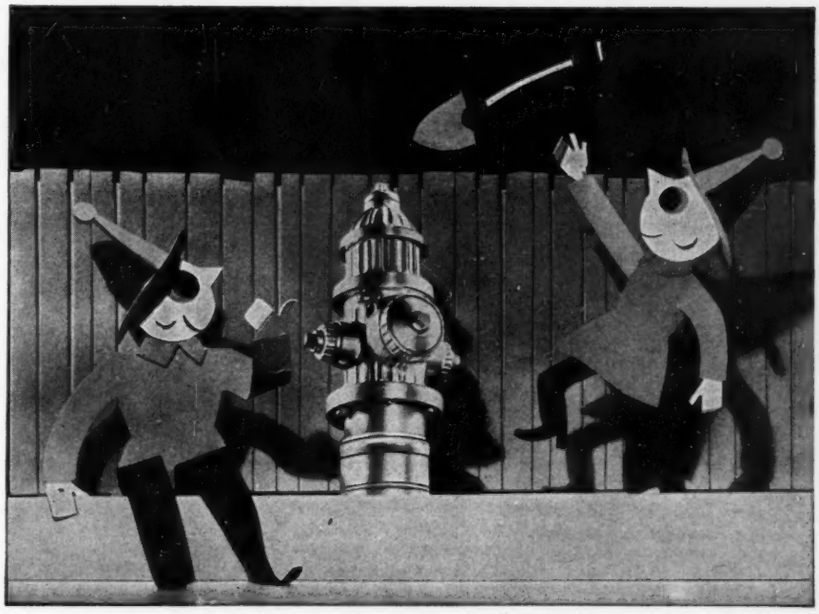
AND SAVINGS STAMPS

"Penchlor" Acid-Proof Cement—a quick-setting, self-hardening sodium silicate cement, is described in an eight-page illustrated booklet just received from the Pennsylvania Salt Manufacturing Co. This cement has been successfully used in water and sewage plants and sewer construction, in chemical plants, steel mills, paper and pulp mills, oil refineries and smelting plants. It is resistant to all organic acids and to all inorganic acids but hydrofluoric. It therefore resists acid attack by sewer gas. Once it has permanently set it becomes resistant to steam, hot and cold water. Several pages of the booklet are devoted to a discussion of approved construction methods in the use of chemical brick and cement. Complete information on the chemical and physical properties of "Penchlor" cement are given. For further information ask for Booklet No. 6, from the Pennslyvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia, Pa.

"Kapco" Sewer Compounds are presented in a new 4-page bulletin issued by Keystone Asphalt Products, describing both their hot pouring and cold troweling compounds. "Kapco" hot pouring compound is acid and alkali proof, root resistant, and makes a permanent, waterproof joint which is sufficiently flexible for ordinary pipe settlement. It is shipped in fibre containers, affecting a saving in steel drums and permitting ready handling. "Kapco" cold troweling compound requires no heating or mixing. It can be applied with or without jute or the new "Fibrex" joint packing, depending on the preference of the engineer. A table gives quantities of "Kapco" compounds required for various pipe sizes. The bulletin may be obtained by writing to the Keystone Asphalt Products Co., 43 E. Ohio St., Chicago, Ill.

Recording Thermometers, for temperature ranges from —125° F. to 400° F., are described in the Bristol Company's new Bulletin T-302. Wet and dry bulb thermometers are furnished with fully compensated, liquid filled measuring systems. A wide variety of charts are available, making it possible to select the range most suited to individual needs. By means of photographs and labeled drawings the bulletin shows all design features of the recording thermometers. To obtain Bulletin T-302, address The Bristol Co., Waterbury, Conn.

Switchboards, standardized in design for economy, yet custom-built to meet individual needs, is the subject of an illustrated bulletin just received from the Allis-Chalmers Mfg. Co. In ten pages of photographs the bulletin shows the variety of switchgear equipment, panelling and housing that can be furnished to order. Standard instruments, panels, switches, relays and meters are used wherever possible to assure low first cost and quick assembly of the units. Panels are constructed of natural black monson slate, ebony asbestos, or stretcher level steel. Types of boards described include vertical panels, duplex panels, benchboards (with meters and instruments mounted on vertical section and switches on bench section), control desks, and switchboards for metal-enclosed switchgear. Drawings show several types of standardized A-C circuit breakers. To obtain Bulletin B-6149, address Allis-Chalmers Mfg. Co., Milwaukee, Wis.



"GIVE YOUR SHOVEL TO THE SCRAP DRIVE"

WE NEVER DIG UP A MATHEWS

The community that has Mathews Hydrants is extra lucky in war time. Once-a-year oiling is the only service they need. Repairs are made with few parts, few men, and *no digging*. For the entire barrel, containing all working parts is as interchangeable as a spare tire. This takes care of traffic smashes, major repairs or overhauls, and modernization. And all parts except those actually broken can be used again.

No wonder Mathews Hydrants have been "tops" for over 70 years.

MATHEWS HYDRANTS

400 CHESTNUT STREET, PHILADELPHIA, PA.

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Made by R. D. WOOD Company

MANUFACTURERS OF SAND SPUN PIPE (CENTRIFUGALLY CAST IN SAND MOLDS) AND R. D. WOOD GATE VALVES

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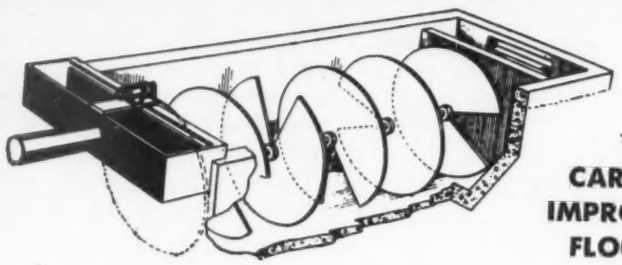
SLUDGE PUMPS · FLOCERS · CONDITIONERS · MIXERS

SELF PRIMING CENTRIFUGAL PUMPS · HUNDINGER PUMPS



★

CARTER IMPROVED FLOCER

Without Paddle Agitation

★ 10% to 25% shorter detention period.
★ Negligible power consumption.
★ Low cost installation and maintenance.
★ A series of flat discs, each with a segment removed, slowly rotated.
★ Agitation is set up by flow of liquid through the open segments.
★ Settling occurs between discs during the travel of the open segment in the upper half of rotation. Flocs are not cut up with a final result of a floc of sufficient size to settle rapidly by the time the mixture passes into the settling tank.

★

PADDLE TYPE FLOCERS AND AERATORS

Certain conditions require increased air diffusion in activated sludge treatment. The Ralph B. Carter Company manufactures a full line of paddle mechanisms. Careful design of shaft and bearings assure long trouble-free life under the necessarily difficult underwater operating conditions.

RALPH B. CARTER COMPANY

NEW YORK OFFICE
43 PARK PLACE

HACKENSACK · NEW JERSEY

84" pipe—Spring Lake, N. J.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

SIZES 2" TO 84"

Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.

75 Federal St., Boston

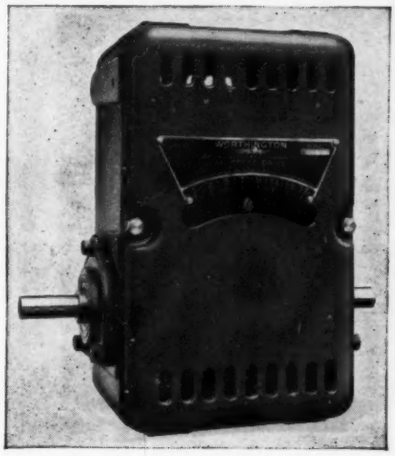
"Type L" Single-Stage Volute Centrifugal Pumps are the subject of a new illustrated folder, Bulletin W-312-B2C, just released by the Worthington Pump and Machinery Corp. These general service pumps, sizes No. 3 to 6, are sturdily constructed and suitable for motor, steam turbine, belt, or engine drive. Units are available with capacities up to 2000 gallons per minute and to handle heads as great as 300 feet. The bulletin contains complete specifications, a cross - sectional drawing showing all special features, photographs of pumps in operation, and a convenient tabulation giving the dimensions and clearances for all parts. For a copy of Bulletin W-312-B2C write to Worthington Pump and Machinery Corporation, Harrison, N. J.

Deaerating Heaters is the subject of a new (revised) 24-page bulletin published by the Permutit. In these units the water is deaerated in two stages. In the first stage, the cold water is heated almost to steam temperature by spraying it through live steam, removing approximately 95 per cent of the oxygen and all of the free CO_2 from the water. Then the resulting hot water is delivered to a re-boiler or steam scrubber, where final and complete deaeration takes place. The bulletin contains numerous photographs of equipment, cross-sectional diagrams and charts showing the performance of Permutit Deaerating Heaters in service. Complete specifications and design data are given. For a copy of the bulletin, write to the Permutit Co., 330 West 42nd St., New York, N. Y.

Soil-Cement Mixtures is the subject of a new laboratory handbook describing the methods of making tests for dependable results with soil and cement mixtures. The moisture-density test, the wet-dry test, the freeze-thaw test, and the compressive strength test are discussed in detail. Methods for identifying and classifying soils so that they can be grouped according to their common characteristics are explained, as are methods for the utilization of this information in selecting soil for soil-cement tests. The handbook also covers a brief review of research on soil-cement mixtures. For a copy write to Portland Cement Association, 33 W. Grand Ave., Chicago, Ill.

EQUIPMENT NEWS

New Variable Speed Drive by Worthington

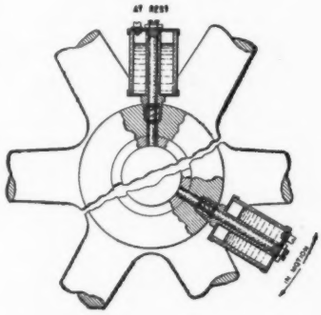


• A new variable speed multiple V-belt-drive is announced by Worthington. This unit has been christened the "ALLSPEED DRIVE". The first of these to be made available is the model A which has a horsepower range of from one-third to three-quarters horsepower with a speed ratio of 16 to 1, that is, any speed from ⅛ to twice the driving motor speed. This drive is said to be exceptionally compact, ball-bearing equipped, and so designed that it can be operated in any plane. Further, it can be directly coupled to any standard motor and the output shaft can be run at motor speed, and is flexible enough to be applied to any type of machine within its power range.

An interesting feature of this drive is its mechanical, postive belt-tensioning device. This device automatically compensates for increased arc of belt contact which results when changing from low to high speeds. In this tensioning device no springs are required. A further feature is the fact that the drive need not be dismantled to change belts. According to Worthington other sizes are now being developed for 1 to 3 HP, 3 to 5 HP, 5 to 7¼ HP, and 7½ to 10 HP.

For additional information address Worthington Pump and Machinery Corp., Harrison, N. J.

New Loose Pulley Oiler



• For use on loose pulleys, idler pulleys, clutches, eccentrics, and similar rotating machine parts, a new wick type lubricator has been announced by the Oil-Rite Corp. of Milwaukee. It is designed to deliver a constant, positive, and regulated amount of filtered oil to shaft or bearing while pulley is in operation, and to prevent oil waste when pulley is idle. The reserve supply of oil is always visible.

This new Oil-Rite Lubricator consists of a simple glass oil reservoir, mounted on a hollow metal stem. This stem is sealed from the oil in the reservoir, except for two small ports at the very top. Inside the stem is a cylindrical felt wick, which extends through the pulley hub to rest directly on the shaft. A compression spring is wrapped around the wick to hold it firmly in position against the shaft.

As the pulley rotates, and the lubricator with it, centrifugal force throws the oil against the top of the reservoir, and into the two ports in the stem—(see cut showing two positions). These admit oil to the wick, which filters out all dirt and sediment, and conducts the oil directly to the face of the shaft.

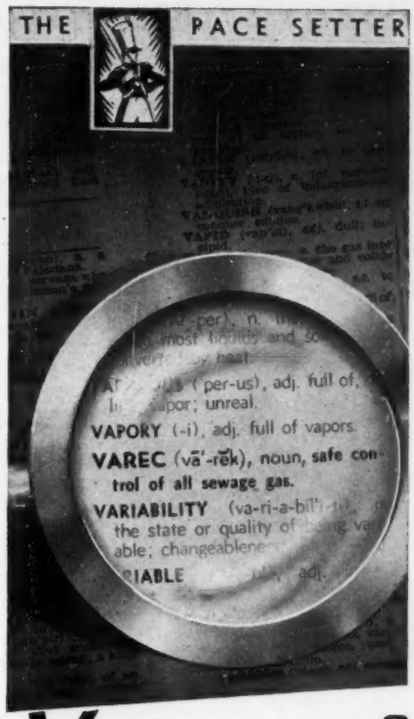
The manufacturer points out that oil flow through the wick results partly from capillary attraction, partly from the suction caused by the drag of the wick on the shaft. Introducing this latter principle, it is claimed, insures these two effects: (1) positive lubrication while pulley is operating; (2) no drippage or oil waste when pulley is idle.

The amount of oil to be delivered to the shaft or bearing is regulated by means of a small plug which controls the area of the oil ports. Reservoir is filled from the top, quickly and easily. Five standard sizes are available—capacities from ¼ to 2½ ounces—for standard tappings from ⅛ to ¼ inches.

Complete details for all applications can be secured by writing to the Oil-Rite Corp., 3466 South 13th St., Milwaukee, Wis.

BUY WAR BONDS

AND SAVINGS STAMPS



"Varec" . . . . . A VITAL WORD IN THE VOCABULARY OF *Every* SANITATION ENGINEER . . . . . .

Thousands of service installations all over the world, backed by progressive engineering, advanced design, first-class craftsmanship and materials, together with rigid inspection and laboratory tests, insure the quality of "VAREC" products.

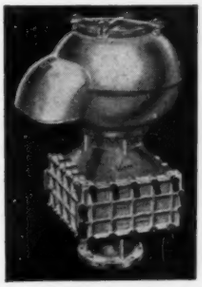


Fig. No. 58 C

"VAREC" Approved Pressure *Relief* and *Vacuum Breaker Valve* with *Flame Arrester*

Installed on digester and gas holder domes, it affords emergency pressure and vacuum relief and prevents flame entrance from atmospheric disturbances. Its telescopic flame-arresting element insures easy inspection and maintenance.

Other "VAREC" Products

Flame Trap Assemblies, Pressure Relief and Vacuum Breaker Valves, Flame Arresters, Flame Checks, Regulators, Check Valves, Drip Traps, Manometers, Explosion Relief Valves, Manhole Covers, Sample Hatches.

THE VAPOR RECOVERY SYSTEMS CO.
Compton, California

Branch Offices and Stocks Carried at New York City; Tulsa, Oklahoma; Houston, Texas

Permanent . . . . .

REDWOOD PIPE Saves critical materials! Long known as a pipe with greater carrying capacity than metal or concrete. Does not clog, scale or pit.

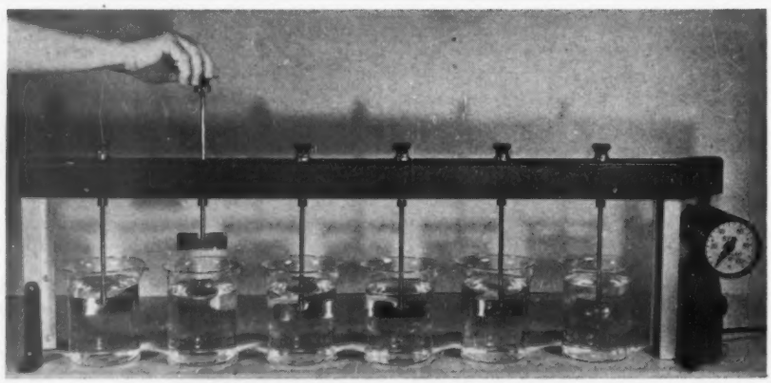
LOWER labor, installation and maintenance costs. Long life, no electrolysis, contamination of water, or destruction by sulphur, salt water or other mineral impurities. New type Wyckoff California Redwood Pipe for water supply and sewage lines is a proven product.

A. Wyckoff & Son Company

ELMIRA, N. Y.

Originators of Machine Made Wood Pipe

1855 — Our 87th Anniversary — 1942



THE *Phipps & Bird* LABORATORY MIXER...

IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.

PHIPPS & BIRD, INC.

RICHMOND, VA.

"SOUTHERN CENTER FOR LABORATORY APPARATUS AND CHEMICALS"

A-C's New System of Transformer Cooling

Saves 25% in Critical Materials; Increases Capacities 20 to 60%

● Vitally needed increases in transformer capacities can now be obtained quickly with the new Allis-Chalmers system of forced-oil cooling that saves 25% in critical war materials on new transformers. The new cooling unit, called the "Electro-Cooler," will step up capacity of transformers already in service by about 20 to 60%, the company reports.

The "Electro-Cooler" consists of a radiator-type cooler and a special pump with motor enclosed. These are connected by piping to the standard radiator valves at the side of the transformer. No stuffing boxes are required in the special pump, and the motor is self-cooled and self-lubricated.

A wartime development designed to save copper and steel, the "Electro-Cooler" is expected to have wide use in post-war applications also. For the current emergency, it can not only be built into new transformers, but can be readily applied to transformers already in service. If the transformers are equipped with the conventional type radiator valves, installation can be made in three to four hours without even removing the oil in the transformer.

Since the application of the "Electro-Cooler" avoids the necessity of adding new transformer units, it is considered a much-needed solution to the wartime problem of over-loaded transformer banks.

Arpex Cement for Under-Water Application

● Arpex Non-Erosive Under Water Cement is a recently developed cement which, when mixed with one to 2 parts of sharp sand, produces a mortar that may be applied under water to stop leaks or make major repairs to dams, conduits, channels, reservoirs, pump pits, etc. Even running water at moderate flow rates does not disintegrate the mortar. It has been used to effectually stop leaks in sewers also.

Literature received goes into case histories in which Arpex Cement has been successfully used in undewater application for stopping leaks through concrete dams, reservoir walls, sewers, etc. The manufacturer offers three types of Arpex Under-Water Cements, and conditions to be met are required before the most suitable type is recommended for the job at hand.

For a copy of the brochure relating successful uses of this new cement and recommendations, write Beach Erosion Control Co., 422 Alden St., Orange, N. J.

"Saluting"---

THE FLYING FORTRESS
—BOEING'S FAMED B-17-E

Out-flying, out-fighting and out-bombing anything it meets in the air—on any front, the Flying Fortress has a reputation of proven superiority. It is a masterpiece of skillful engineering born of wide research and countless experiments. To such war equipment Americans pay thankful and admiring tribute.

But for men who build such planes, those who train to fly them—and for millions of people at home, there must be an abundance of water. To a water system the name Layne is as famed as that of Boeing to long range bombers. Layne has built thousands of water systems—the very biggest in the United States. Layne likewise builds pumps—the kind that outpump, out-last and out-perform any deep well water producing equipment in any territory—on any task.

Layne's reputation, like that of the Flying Fortress has been proven the hard way—on the field of action. Layne Wells and Pumps by the hundreds are producing millions and millions of gallons of water for manufacturers, cities, railroads and the army and navy. For late catalogs, bulletins and detail information, address

LAYNE & BOWLER, INC.
Memphis, Tenn.

LAYNE
PUMPS & WELL
WATER SYSTEMS

Affiliated Companies

Layne-Arkansas Company.....Stuttgart, Ark.
Layne-Atlantic Company.....Norfolk, Va.
Layne-Bowler New England Corp...Boston, Mass.
Layne-Central Company.....Memphis, Tenn.
Layne-Northern Company.....Mishawaka, Ind.
Layne-Louisiana Company.....Lake Charles, La.
Louisiana Well Company.....Monroe, La.
Layne-New York Company.....New York City
Layne-Northwest Company.....Milwaukee, Wis.
Layne-Ohio Company.....Columbus, Ohio
Layne-Texas Company.....Houston, Texas.
Layne-Western Company.....Kansas City, Mo.
Layne-Western Co. of Minn.....Minneapolis, Minn.
International Water Supply, Ltd...London, Ont.

WORLD'S LARGEST WATER DEVELOPERS

Explosion Proof Timers

● To meet the many present day demands for Explosion Proof Timers suitable for operations in gaseous atmospheres or where there is a potential danger of explosion due to sparking, The R. W. Cramer Co., has just placed on the market a line of timers to meet such specifications.

Type TDLC Explosion-proof Time Delay Relay is laid out for panel board mounting with the setting knob and dial projecting.

Within this housing it is feasible to mount either a TDLC or TDL with a small relay. The latter construction would be used where it is desired to control the timer from a remote located momentary start button.

For descriptive literature write The R. W. Cramer Co., Inc., Centerbrook, Conn.

New Line of Plug Valves

● Homestead Valve Mfg. Co. of Coraopolis, Pa. announces a new line of "Lever-Sealed" Plug Valves for 150 pounds working pressure.

Face to face dimensions of each valve in the new line are the same as those of the corresponding size of wedge-gate valve. Thus they are instantly interchangeable with wedge-gate valves, without piping changes.

Other features of the new line include Homestead's traditional "quarter-turn" operation, and a powerful leverage to provide positive, extra-easy opening or shut-off under all conditions.

Sizes range from 1½" to 10", in either semi-steel or steel.

For descriptive literature write Homestead Valve Mfg. Co., Coraopolis, Pa.

Three-Way Butterfly Valve for Mixing and Quick Interchange

Unusually quick action is provided in a three-way valve of the butterfly type according to R-S. Products Company, Philadelphia. It is designed for mixing and quick interchange service and adapted to fully automatic control by means of an air diaphragm motor or hydraulic cylinder.

The valve is constructed of cast steel or cast iron for pressures up to 600 p.s.i. When desirable, special metals for resistance against heat, abrasion and corrosion can be substituted.

A special feature of the valve is the self-cleaning, double-beveled, streamlined vane. It seats wedge-tight against the body of the valve thus producing a tight shut-off as well as positive control of volume and pressure. For inaccessible locations, a reach rod with de-clutching unit is provided for automatic operation or manual control in case of power failure.

For further details write R. S. Products Corp., Wayne Junction, Philadelphia.

·1879·
ROSS
AUTOMATIC VALVES

ALTITUDE VALVES
for
Control of elevation and heads into and out of tanks, basins and reservoirs.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.

COMBINATION VALVE
Combination automatic control both directions through the valve.
A self-contained unit, with three or more automatic controls.

REMOTE CONTROL VALVE
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

ROSS VALVE MFG. CO.
INCORPORATED
P. O. BOX 595, TROY, N. Y.

THE LINING IS IMPERVIOUS — THE JOINTS ARE LAPPED

LIPCO PIPE

AVAILABLE *Now!*

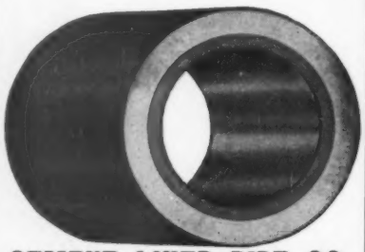
Immediate DELIVERY

ON

STEEL, TONCAN IRON

AND WROUGHT IRON

Cement Lined Service Pipe



CEMENT LINED PIPE CO.

Lynn, Mass.

INQUIRIES INVITED

on all Problems of

WATER TREATMENT

Whether your problem of water rectification is large or small, we have a form of equipment to serve your needs. We manufacture and install equipment for Gravity Filtration and Softening Plants; Pressure Filters and Zeolite Softeners; Swimming Pool Recirculating Appliances; and Water Treatment Units of all types.

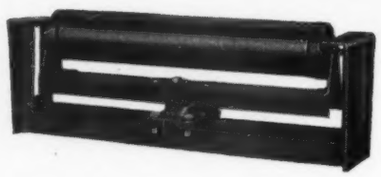
ROBERTS FILTER MFG. CO.

607 COLUMBIA AVE.

DARBY, PA.

New Idler for Longer Conveyor Belt Life

● Chain Belt Co. announces a new self-aligning idler for flat conveyor belts, both return and carrying, which will help to keep the belt central on its supporting idlers, important for longest possible life from a conveyor belt.



The operation of this self-aligning idler is sensitive and instantaneous. If for any reason, the conveyor belt runs to one side it has a tendency to swivel the idler in a horizontal plane. If this in itself is not sufficient to cause the idler to swing enough to force the belt to throw back immediately, the belt will continue traveling to one side until it contacts the counter-weighted end disc, which is slightly larger in diameter than the idler roll. Contact with the counterweight tends to rotate but since it is a counterweight it resists this tendency to rotate and produces a counterforce on the idler. This causes the idler to swivel rapidly, throwing the idler more out of line which then immediately forces the belt to swing back the other way.

For further information write Chain Belt Co., Milwaukee, Wis.

New Carbon Dioxide Multi-Purpose Fire Extinguisher

● American-La France-Foamite Corporation's new Alfite carbon dioxide engine is said to be the only 100 lb. engine approved by Underwriters' and Associated Factory Mutual Laboratories for use on both electrical and oil fires .

It is also equipped with an Anti-Statik horn to protect the operator from static charge, according to the manufacturer. It is designed for perfect balance at wheeling height, has a third swivel wheel for easy maneuvering, and a retaining latch which releases horn instantly, yet holds it firmly in place when not in use.

Where Is The Largest Rotary Distributor Installation in the U. S.?

Dayton, Ohio, with twenty 165'-diameter P.F.T. units — one of dozens of installations pictured and described in Bulletin No. 213.

The engineering data it contains shows why P.F.T. Rotary Distributors are by far the most widely used. Send for a copy.

P.F.T.

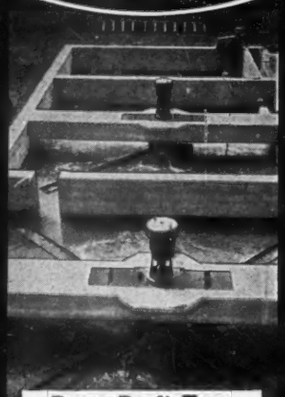
PACIFIC FLUSH-TANK COMPANY

4241 Ravenswood Ave., Chicago, Ill.

New York Charlotte, N. C.

AER-O-MIX

AERATOR — MIXER



Down-Draft Type MECHANICAL SEWAGE AERATORS

Write for information on AER-O-MIX for your SEWAGE or WATER TREATMENT APPLICATION.

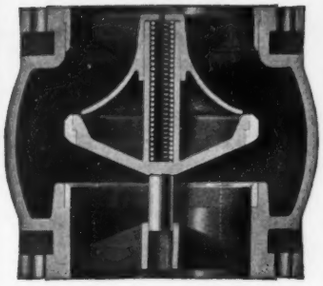
VOGT MFG. CO.

INCORPORATED

P. O. Box 1122 Louisville, Ky.

SMOLENSKY

VALVES



■ The Smolensky Radialflow Noiseless Check Valve eliminates friction head loss, which assures operating efficiency and noiseless operation.

Designed to be constructed with a cast iron body, plug, spider, and made with a renewal bronze valve seat or seat of other metal when required.

Specify Smolensky Valves for your water works plant and assure yourself years of trouble-free service.

●

Economy—Durability

THE SMOLENSKY VALVE CO.
1931 W. 47th STREET, CLEVELAND, OHIO

LEADITE

The Pioneer Self-Caulking Material for C.I. Pipe

TABLE OF COMPARATIVE QUANTITIES

Nominal inside dia. of pipe, in.	Depth of joint, inches of Leadite	Approx. lbs. of Leadite per joint	Depth of joint, inches of lead	Approx. lbs. of lead per joint
4	2.5	2.00	2.25	8.56
6	2.5	3.00	2.25	11.71
8	2.5	4.00	2.25	14.63
10	2.5	5.00	2.25	17.70
12	2.5	6.00	2.25	20.86
14	2.5	7.00	2.25	24.02
16	2.5	8.25	2.25	33.07
18	2.5	9.25	2.25	36.88
20	2.5	10.50	2.25	40.71
24	2.5	13.00	2.50	53.02
30	2.75	16.00	2.50	65.36
36	2.75	19.00	2.50	77.96
48	3.50	30.00	3.00	121.15
54	4.0	38.00	3.00	135.60
60	4.0	42.00	3.00	150.70

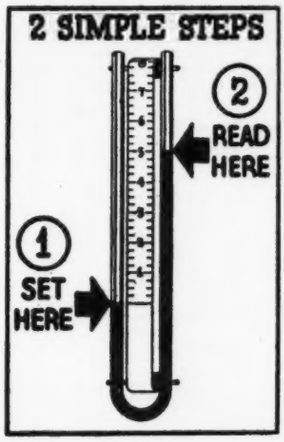
THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia, Pa.

No Caulking

It is recommended for fires in flammable liquids, alcohol storage, electrical machinery, and for other class "B" and "C" fires. It smothers fire instantly with carbon dioxide gas which expands upon discharge to 450 times its stored volume. It is non-corrosive, non-poisonous, odorless.

For additional information write American-La France-Foamite Corp. of Elmira, N. Y.

Direct Reading Manometers



● Operating on a unique sliding scale principle a new direct reading U-tube manometer is offered by Trimount Instrument Co. of Chicago. It has a flexible steel sliding scale which operates over pulleys, is easy to set accurately and, thereafter, obtain direct readings without danger of errors which occur when adding and subtracting readings on fixed scale U-tube manometers.

The instrument hardly needs any further description in this column, but details are given in a catalog of Trimount Manometers, Flow Indicators and Tank Level Gauges. For a copy write Trimount Instrument Co., 406 South Plymouth Court, Chicago.

Protective Coating for Preservation of Drawings, Documents, Etc.

● Protective Coatings, Inc. of Detroit are offering a transparent and colorless protective coating for the preservation of important records, master drawings, blue-prints, contracts, etc.

The coating (No. 30) is applied by dipping, crushing or spraying, the drying time being 3 to 5 minutes and is guaranteed protection against water, grease, sunlight, handling, and normal deterioration. A gallon can goes a long way—600 to 800 sq. ft. of coverage.

For details and sample, write Protective Coatings, Inc., 10391 Northlawn, Detroit.

When You Specify

Meters and Recorders

Be Sure To Demand

●ACCURACY ●RELIABILITY
●SOUND ENGINEERING
●MODERN APPEARANCE

Regardless of whether your problem calls for the use of a Venturi Tube, Weir, or Flume, you can depend on Bailey Meter Company to design and construct both the primary element and the register for maximum accuracy.

A vast amount of experience gained from thousands of installations of metering equipment, together with extensive experimental work in our own hydraulic laboratory and in the laboratories of the Ohio State University, Cornell University, Case School of Applied Science and other institutions, is back of every Bailey Primary Element.

The reliability of Bailey Meters and Recorders is attested to by the fact that thousands of dollars worth of steam and water are sold monthly and billed solely on the basis of readings from Bailey Meters.

No small share of the accuracy and reliability of Bailey Meters is due to the conservative engineering policy of the Company. New ideas and designs are not offered for sale until they have been thoroughly tested both in the laboratory and in actual service.

Bailey Meters, Recorders and Controllers present a thoroughly modern yet conservative appearance.

Write for your copy of Bulletins No. 301 and 302, describing Bailey Fluid Meters for steam, liquids, gases, sewage, sludge, and compressed air.

MU-16

BAILEY METER
• COMPANY •
1072 Ivanhoe Road, Cleveland, Ohio
BAILEY METER COMPANY LTD., MONTREAL

Single-Acting Semi-Throttling Altitude Valve

Installed in upstream line to tanks, standpipes or reservoirs, this valve sensitively maintains any desired water level to prevent overflow.

The valve is semi-throttling by gradually closing as water approaches the maximum water level to be controlled. The valve is self-contained without any waste of water from above the valve piston, and is especially desirable for service where a low head is to be maintained against a higher influent pressure.

Write for Specifications and Prices.

GOLDEN-ANDERSON VALVE SPECIALTY CO.
Fulton Building Pittsburgh, Pa.

FORD MONITOR COVERS

These covers are made for 24", 30" and 36" tile. All have 20" lid openings, are 7" in depth and can be provided with inner lids if so ordered.

Monitor Covers are satisfactory for 1½" and 2" meters, or for two or more smaller meters. All have the Lifter Worm Lock with forged Everdur bolts. Write for catalog.

FORD METER BOX CO.,
WABASH, IND.

A New One Coat Paint

• A new paint product that primes, seals and finishes on any interior surface in one coat, has been announced by the American-Marietta Co.

Designated Valdura Singlekote, this paint combines the hiding power and economy of water-type paints with the washability, durability and performance of oil-type coatings. It may be applied to surfaces previously coated with calcimine or casein paints, providing the old covering is bonded, or tight to the wall. Interior surfaces that may be covered are plaster, concrete, brick, wallboard, wood, wallpaper and metal. Coverage is up to 750 square feet per gallon. High hiding power permits coverage of dark surfaces with a single coat, and the product is self-leveling. It sets within two hours, dries within 12 hours, and provides a dead-flat finish when viewed at a 90-degree angle.

For further details write the American-Marietta Co., 43 East Ohio St., Chicago.

Signaling Controller for Condensate Purity

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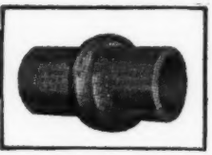

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"Tony" Anable Back in Navy Service

1917-'19 Ensign Now Lieut.-Commander

• Anthony Anabel Dorr Company's Advertising and Publicity Manager has been given leave of absence to "join-up" again with the U. S. Navy as Lieutenant-Commander. For the present he is located at the Officers Training School of the U. S. Naval Reserve, New York City.

In the scrap of 1917-1919 Mr. Anable served as Ensign on one of the naval transports that carried the first A.E.F. to France. He has been connected with the Dorr Co. since 1923 and Adv. Manager since 1932.

In Mr. Anable's absence Mr. Albert Morris becomes Acting Publicity Manager.

Columbia Names New Manager for N. Y. Sales Office

K. C. Frazier

The Columbia Chemical Division (chlorine, alkalies and other heavy chemicals) of Pittsburgh Plate Glass Co. last month appointed K. C. Frazier as district sales manager for New York City and its metropolitan area.

Mr. Frazier is a graduate of Colgate University and a member of the Delta Kappa Epsilon fraternity. For the last ten years he has been Southwestern manager of the Southern Alkali Corporation, an affiliate of the Pittsburgh Plate Glass Co.

This announcement was made on Aug. 24 by W. I. Galliher, Columbia's director of sales, whose headquarters has recently been moved from New York to Pittsburgh, as the result of the removal of Columbia Chemicals' executive sales office to Pittsburgh.

Another Chlorine Producer Awarded Army-Navy Production Award

An invitation was received by the editor of WATER WORKS AND SEWERAGE to attend the ceremonies at which the Army-Navy Production Award (known as the Army and Navy "E") was presented to the Hooker Electrochemical Co. and the employees of the Niagara Falls plant of this company.

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Worthington Appoints R. J. Laidlaw Cleveland Manager

● Worthington Pump and Machinery Corp. announces the appointment of R. J. Laidlaw to the position of Manager of its Cleveland district office. Mr. Laidlaw will succeed Mr. A. J. Klug who will now devote his entire time to special work with certain important industries in the Cleveland district.

Mr. Laidlaw has been connected with the Worthington organization in various capacities since his return from overseas in 1919 from active service with the 32nd Division of the 120 M.G. Battalion in World War I.

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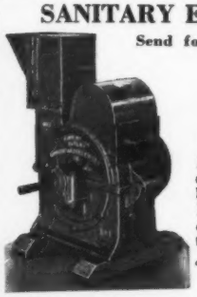

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With the influx of new workers into war-plant communities...

CHLORINATION AGAIN PROVES ITS VALUE AS A SEWAGE PLANT *SAFETY RESERVE*

The sudden, unexpected population growth now taking place in many communities is putting an extra burden on sewage treatment facilities right at a time when expansion is impossible or subject to serious delay.

Yet many of these communities have found it possible to "carry on" without lowering their sanitary standards, and without creating objectionable conditions around the plants.

The answer is the SAFETY RESERVE they have in modern W&T Chlorinators. Though this equipment may have been used only in an auxiliary way under *normal* conditions, it was ready and waiting to raise the efficiency and effective capacity of the plant in the face of the abnormal load.

Peak loads . . . drought conditions . . . hot spells . . . breakdowns in equipment which cannot be immediately replaced . . . these and other emergencies are being more easily overcome where W&T Chlorinators are an integral part of the plant installation. SA-138

W&T Chlorinators meet the needs of all types of sewage treatment plants. Application may be controlled manually, automatically (proportional to flow) or on a programmed "step-by-step" basis. And with W&T *potential chlorination*, changes in both strength and flow of sewage are instantly met with proper changes in the application rate.

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